INSTITUTE
for ADVANCED STUDY

REPORT

FOR THE ACADEMIC YEAR

2002 – 2003

PRINCETON · NEW JERSEY

ARCHIVES
Institute for Advanced Study
Princeton, New Jersey 08540

INSTITUTE
for ADVANCED STUDY

REPORT

FOR THE ACADEMIC YEAR

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Extract from the letter addressed by the Institute's Founders, Louis Bamberger and Mrs. Felix Fuld, to the Board of Trustees, dated June 4, 1930.

Newark, New Jersey.

> *It is fundamental in our purpose, and our express desire, that in the appointments to the staff and faculty, as well as in the admission of workers and students, no account shall be taken, directly or indirectly, of race, religion, or sex. We feel strongly that the spirit characteristic of America at its noblest, above all the pursuit of higher learning, cannot admit of any conditions as to personnel other than those designed to promote the objects for which this institution is established, and particularly with no regard whatever to accidents of race, creed, or sex.*

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INSTITUTE FOR ADVANCED STUDY
BACKGROUND AND PURPOSE

The Institute for Advanced Study was founded in 1930 with a major gift from New Jersey businessman and philanthropist Louis Bamberger and his sister, Caroline Bamberger Fuld, who wished to use their fortunes to make a significant and lasting contribution to society. They sought the advice of educator Abraham Flexner, who developed the concept of the Institute as a community of scholars whose primary purpose would be the pursuit of advanced learning and scholarly exploration. The Institute for Advanced Study has sustained its founding principle for over seventy years. This commitment has yielded an unsurpassed record of definitive scholarship.

The Institute fills a unique role in postgraduate education and scientific and scholarly research. As "the university to universities," in the words of Trustee Vartan Gregorian, the Institute serves all colleges and universities by providing a place where scholars can hone their skills and do their best work, thereby adding substantially to their ability to contribute as both teachers and scholars to the academic institutions where they base their careers. For young scholars just entering the academic world, an opportunity to work at the Institute can set the direction for lifelong research interests and thereby determine professional careers. The Institute provides more mature scholars with the opportunity to take a new direction in their research or to complete a major piece of work away from the many obligations and distractions of working life at a contemporary university. In our era, a time when pure research and scholarly activities are undervalued, these opportunities are exceedingly rare.

The Institute's foremost objective is the advancement of knowledge and the deepening of understanding across a broad range of the humanities, sciences, and social sciences. One of the Institute's unique strengths is its small and distinguished permanent Faculty, well-established scholars whose broad interests and extensive ties to the larger academic world are reflected in their own work and also in the guidance and direction they provide to the Institute's visiting Members. The Faculty defines the major themes and questions which become the focus of each School's seminars and other activities, and the Faculty selects and works closely with visiting Members. Small in number and organized in four Schools (Historical Studies, Mathematics, Natural Sciences, and Social Science), the Faculty and Members can interact with one another without the departmental and disciplinary barriers found in universities.

Each year the Institute awards fellowships to some 190 visiting Members from universities and research institutions throughout the world. The Institute's 5,000 former Members hold positions of intellectual and scientific leadership in the United States and abroad. More than a dozen Nobel laureates have been Institute Faculty or Members, and many more are winners of the Wolf or MacArthur prizes. Thirty-one out of forty-three Fields Medalists have been Institute Faculty or Members.

The Institute does not receive income from tuition or fees. Resources for operations come from endowment income, grants from private foundations and government agencies, and gifts from corporations and individuals.

"It seemed to me that the time was ripe for the creation in America of an institute in the field of general scholarship and science ... not a graduate school, training men in the known and to some extent in methods of research, but an institute where everyone—faculty and members—took for granted what was known and published, and in their individual ways endeavored to advance the frontiers of knowledge."

—Abraham Flexner, Founding Director (1930-39) of the Institute, Memorandum to the Board of Trustees of the Institute for Advanced Study, September 26, 1931

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JAMES STEPHENS
Computer Manager, School of Natural Sciences

THOMAS HOWARD UPHILL
Computer Manager, School of Mathematics

PROFESSOR-AT-LARGE EMERITUS

HARRY WOOLF
(deceased January 6, 2003)

ARTIST-IN-RESIDENCE

JON MAGNUSSEN

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(in order of service)

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MARVIN L. GOLDBERGER · PHILLIP A. GRIFFITHS

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(current Faculty and Faculty Emeriti are in bold)

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"There is no doubt in my mind that the Institute provides conditions for thinking and writing which are unmatched anywhere in the world."

—Member, School of Historical Studies

Director

In 1991, when Phillip Griffiths agreed to be Director of the Institute, the Board of Trustees and Faculty knew that the future of the Institute would be in good hands, but we could not have foreseen the vitality that his leadership would provide. Our 1991 Annual Report described the general climate for higher education as a "time of questioning and challenge for some of our finest institutions." In addition, the report noted that "many educational leaders are less confident than they were a decade ago of the ability of institutions to respond effectively to future needs and to fulfill their missions."

However, within a brief time it was clear that, with Phillip's leadership, the Institute for Advanced Study would begin a period of deep strengthening. The Schools were responding to events in the world at large, such as the fall of the Berlin Wall, when the School of Historical Studies convened an international conference on "German History from the Perspective of Art Collectors, Donors, and Museums" that brought together leading scholars from Europe and the United States in history and art history. The conference was supported by the Fritz Thyssen Stiftung and The Andrew W. Mellon Foundation. Ensuing years brought other international collaborations, including the initiation of the New Europe Prize, created in collaboration with centers of advanced study in the United States and Western Europe. The New Europe Prize was created to assist selected scholars who had come to our institutes and had returned to their home institutions in Eastern Europe and the former Soviet Union.

In the spring of 1992, the School of Mathematics' year-long focus on emerging areas of applied mathematics culminated in a week-long conference on fluid dynamics, supported by the Alfred P. Sloan Foundation. Explorations also began at the intersection of mathematics and the sciences, where there was the prospect of significant discovery or insight flowing from mathematical applications. After several years of visiting appointments in theoretical computer science, the Institute's School of Mathematics established a Faculty position in this field.

Early steps also addressed Institute infrastructure, and Simonyi Hall, a long-needed home for the School of Mathematics, and Wolfensohn Hall, a center for lectures and concerts for the entire Institute, were built. The computing environment was expanded and the fiber optic cabling network upgraded. These efforts would be followed in later years by the creation of Crossroads Child Care Center, the renovation of the Library Annex and construction of the Shelby White and Leon Levy Room, the renovation of our 169-apartment Member housing complex, and the construction of Bloomberg Hall, which joined two existing buildings to allow the School of Natural Sciences to be housed in one central building for the first time in its history.

The creation of Bloomberg Hall is typical of the manner in which actions were taken in response to academic needs. The Faculty and Director saw that science at the frontier in particle physics and astrophysics was merging, and to pursue this most effectively it would be necessary to have scientists from these areas rubbing elbows rather than working in their own groups in separate buildings. In addition to the physical consolidation of the School, funds, provided in part by the W.M. Keck Foundation, were necessary to support new

research work. Bloomberg Hall, plus funds for the frontier science being pursued within its walls, resulted in a dynamic new environment for the School.

Distinguished academic leaders Hanna Gray and Henry Rosovsky were invited to chair Visiting Committees to each of the Schools. Following this process, Trustees Helene Kaplan and Richard Black co-chaired the Decadal Review. One recommendation that resulted from the review was for greater flexibility in various areas. Shelby White and Leon Levy generously responded to Phillip's request to create a fund for new initiatives, and theoretical biology became a special program with the support of this and other new funding. Other academic decisions made during this time included the resumption of economics within the School of Social Science and the creation of a Chair in East Asian Studies in the School of Historical Studies. Outstanding Faculty appointments were made in both existing and new areas.

Phillip's concern for the education of future scholars led to the IAS/Park City Mathematics Institute, Prospects in Theoretical Physics, and the Women's Program in Mathematics. In addition, the Artist-in-Residence program was established, and it has been greatly valued by the current Members and Faculty, as well as the larger community. A major accomplishment of the Institute was the preservation in a permanent conservation easement of 589 acres of Institute Woods and farmlands. This legacy, of environmental and historical importance, will remain in perpetuity.

In January, Phillip will join the Faculty of the School of Mathematics. He is the only Director other than J. Robert Oppenheimer to be invited by a School to become a Faculty Member. The Institute will, at that time, have the privilege of welcoming Peter Goddard, Professor of Theoretical Physics in the Department of Applied Mathematics and Theoretical Physics, University of Cambridge and Master of St. John's College, as the eighth Director of the Institute for Advanced Study. We enthusiastically look forward to working with Peter Goddard and to his future leadership of the Institute. I also extend my appreciation to Martin Leibowitz, who chaired the Search Committee, and to each of the Faculty and Trustees who served the Institute in the significant process of selecting the next Director.

Trustees

The Institute is deeply grateful to Nathan Myhrvold, Martin Rees, and Ladislaus von Hoffmann for their dedicated years of service to the Board of Trustees. We are pleased that Laszlo will continue to serve as a Trustee Emeritus and look forward to new ways that Nathan and Martin will be involved with the Institute in the future.

We are pleased to welcome Andrew Strominger, Professor of Physics at Harvard University, as the Academic Trustee for the School of Natural Sciences. A former long-term Member at the Institute (1982-87), Dr. Strominger was Professor of Physics at the University of California at Santa Barbara (1986 to 1997). A theoretical physicist, Dr. Strominger's research concerns quantum gravity, string theory, and quantum field theory. Dr. Strominger earned his B.A. at Harvard, his M.A. at the University of California at Berkeley, and his Ph.D. at Massachusetts Institute of Technology. A former Department of Energy Outstanding Junior Investigator and Alfred P. Sloan Foundation Fellow, he is a senior fellow of the Harvard Society of Fellows.

The Trustees are also delighted to welcome Shelby White, author, collector, and philanthropist, to the Board. She received her B.A. from Mount Holyoke College and her M.A. from Columbia University. A member of the board of The Metropolitan Museum of Art, she also serves on the Visiting Committee of the Freer and Sackler Galleries and the Harvard Museum Visiting Committee. In addition, she sits on the boards of The Mount Holyoke College Art Museum, The Bard Graduate Center, The Writers Room and The New York Botanical Garden. Shelby is chair of the White-Levy Program for Archaeological Publications. She and her late husband, Leon Levy, have been the sponsors of the excavations at the ancient Canaanite city of Ashkelon, Israel. These excavations are directed by Lawrence Stager of Harvard University and have operated continuously for 17 years. Shelby White and the late Leon Levy have also funded work done by Dr. Robert Ballard in the discovery of ancient Phoenician shipwrecks, as well as programs in various areas at the Institute of Fine Arts, Rockefeller University, and the Institute for Advanced Study.

In Memoriam

In the year past, the Institute lost an extraordinary number of leaders beloved by the Institute.

Harry Woolf served as Director of the Institute for Advanced Study from 1976-87 and subsequently Professor-at-Large until his passing on January 6, 2003. The Board's resolution of April 25, 1987, noted, "With high heart and deft hand, Harry Woolf has led the Institute for Advanced Study steadily forward for over a decade. He has gathered its separate parts into a whole, forging a stronger and sounder enterprise. Student and scholar, historian and man of science, he has read the past and anticipated the future: he has insured the Institute's place in time...His insight and energy, ability and good humor have secured a great legacy, and in recognition thereof the Board of Trustees herein expresses its deep appreciation and warm affection." During Harry's time as Director, the Institute's Archives were established, and the centennial of the birth of Albert Einstein was celebrated with a major symposium that brought scientists and humanists together. The proceedings were collected in the volume he edited, *Some Strangeness in the Proportion: A Centennial Symposium to Celebrate the Achievements of Albert Einstein*. In addition, *A Community of Scholars*, an invaluable work of reference and a record of the Institute's Faculty and Members during its first fifty years, was published. The Institute is deeply grateful for the leadership Harry Woolf provided the Institute during his years as Director.

Leon Levy served as a Trustee of the Institute for Advanced Study for fifteen years, and his many contributions were unique. His own intellectual vitality was remarkable, and his interests wide-ranging, so he found it natural that scholars at the Institute would be driven by their intellectual curiosity. He contributed to his role as Chair of the Executive and Finance Committees, Vice Chairman of the Board, and President of the Corporation all of the remarkable talents and qualities that made him a legendary financier. His business acumen, leadership skills, and practical wisdom ensured that the Institute remained on a sound financial course during a period when the ability to chart that course was possessed by very few. In his last two years of chairing the Finance Committee, the return on the Institute's endowment was in the top 1% of comparable endowments.

Family was extremely important to Leon, and in so many ways, he made us feel as though the Institute had become a part of his family. His enormous contributions of time and advice regarding all manner of Institute concerns; his wonderful sense of humor and con-

tagious enthusiasm; his formidable financial intuition; his willingness to take risks and hold big positions, whether in the financial arena or the academic one: for all of these gifts that Leon gave so generously, we are most grateful. Leon Levy speculated some years ago in a letter to Phillip Griffiths, "If I have been a very good fellow in this incarnation, perhaps I will be fortunate enough to come back as a scholar in the next." The Institute for Advanced Study expresses its profound appreciation for the life of Leon Levy, for his wise influence and guidance, and for the pride and pleasure we found in his friendship.

The Institute also lost a treasured friend, Frank E. Taplin, Jr., Trustee and Trustee Emeritus for more than thirty years. Frank passed away on May 11, 2003. Articulate on behalf of the Institute's mission, Frank Taplin believed strongly in the Institute's role in the creation of new knowledge and in the mentoring of young scholars and scientists. With his wife, Peggy, he endowed two Memberships in the School of Natural Sciences. A man who always led by example, Mr. Taplin inspired support over the years for various Institute initiatives, including the IAS/Park City Mathematics Institute and the Artist-in-Residence program, at critical points for these programs.

In 1997, Frank's personal leadership was vital in seeding the Institute's efforts to preserve 589 acres of Institute Woods and contiguous farm fields, a key ecological link in a network of open space between New York City and Philadelphia. Frank's vision encompassed the environment, music, education, and human rights, and he was driven by a love of music, poetry, language and learning. We shall always cherish Frank's personal curiosity, great intelligence, and richness of spirit.

Patricia H. Labalme served the Institute in many capacities including Associate Director (1982- 88), Secretary of the Corporation (1982-92), and Assistant to the Director (1992-7). But these formal titles describe only some of her many contributions to our intellectual and financial well-being. Patsy collected oral histories and consulted about projects with faculty in the Schools of Historical Studies and Social Science. In the early days she helped write grant proposals, and later, as a trustee of the Gladys Krieble Delmas Foundation, she generously supported many of our efforts by funding memberships and conferences. Her deep commitment to humanistic learning was evident in the kinds of work she chose to support as well as in her own scholarship. Patsy's love of the Renaissance brought her into contact with the medievalist and early modern historians at the Institute. She was the author of *Bernardo Giustiniani: A Venetian of the Quattrocento* (1969) and editor of a collection of essays, *Beyond their Sex: Learned Women of the European Past* (1980). At her death she was working on a book on the Venetian diarist, Marin Sanudo. Patsy's remarkable commitment to the Institute, her intelligence, and her friendship will be treasured always by Trustees, Faculty, and Members alike.

In looking to the future, I am pleased to announce that at our spring Board meeting, Richard B. Black was elected as Vice Chair of the Board, joining Martin L. Leibowitz in that office, and Charles Simonyi was elected to the position of President of the Corporation.

With the leadership that has preceded and the plans in place for the future, I have great faith that the Institute will continue to be an incomparable incubator for young scholars and the most distinctive intellectual reservoir for pure knowledge.

James D. Wolfensohn

REPORT OF THE DIRECTOR 2002-03

It is with a profound sense of gratitude and fulfillment that I write my final report as Director of the Institute for Advanced Study. It has been a privilege and a pleasure to serve at the helm of this marvelous institution for the past twelve and a half years, and I owe a deep debt of gratitude to so many of you - Faculty and trustees, Members and visitors, staff, professional colleagues, donors and friends - who have helped make my tenure as Director the experience of a lifetime.

Three quarters of a century after it was established, the Institute remains true to the course set by our founding Director, Abraham Flexner, to create a "free society of scholars - free, because mature persons, animated by intellectual purposes, must be left to pursue their own ends in their own ways." While institutions everywhere have struggled in recent years to define or adjust their missions, our own institution remains steadfast in its commitment to support the most advanced level of scholarship. Nor have we wavered from our educational mission, for we share the conviction of our founder and his successors in this office that the true scholar has dual objectives: to discover new knowledge, and to act as a mentor and model for the next generation of scholars. The Institute is dedicated to creating the most fertile learning environment for our visiting Members.

A multitude of research institutions now exist, many of them deliberate copies of our own Institute for Advanced Study. But ours remains distinctive in breadth, organization, mix of permanent faculty and Members, and especially in its unique culture. Its resource base is significant, its excellence unparalleled. George Kennan's observation is as apt now as it was when he wrote these words many years ago: ". . . I have no hesitation in suggesting that there has been no other place in the world from which, scholar for scholar and square foot for square foot, more and finer scholarship has emerged over these past 40 years than from these surrounding walls."

During my time as Director, new fields have emerged here at the Institute, both fields that are truly "new," and fields that are new to the Institute, and in which we have decided the Institute can make a contribution.

One such field is East Asian Studies, and I am very pleased to announce the appointment of Nicola Di Cosmo to the faculty of the School of Historical Studies, effective July 1, 2003, as the first Luce Foundation Professor of East Asian Studies. Professor Di Cosmo is a specialist in the relationship between China and its northern neighbors, the nomads of the Inner Asian steppes. Prior to coming to the Institute, Professor DiCosmo taught at the University of Canterbury in Christchurch, New Zealand; Harvard University; and Indiana University. He was a research fellow at Cambridge University from 1989 to 1992.

Professor Di Cosmo earned his B.A. (Laurea) in Chinese Studies from the University of Venice (1982), and received his Ph.D. in Inner Asian History from Indiana University (1991). He was a visiting Member in the School of Historical Studies in the spring semester, 1999. The author of two books, Professor Di Cosmo has served as co-author, editor, or co-editor of five additional books, and has also written numerous articles and book chapters. He is on the advisory or editorial boards of the *Journal of East Asian Archaeology*, *Asia Major*, and *Inner Asia*, and is currently working on books to be titled,

"A Military History of the Manchu Conquest of China" and "The Mongol Empire in World History."

The Institute community has been deeply saddened by the deaths of two Faculty members this year.

Armand Borel, an internationally recognized mathematician whose work was fundamental to the development and formation of modern mathematics, died on August 11, at the age of 80. He was a Professor Emeritus in the School of Mathematics, where he had been a member of the Faculty since 1957.

In 1991, Professor Borel received the American Mathematical Society's Steele Prize for lifelong contributions to mathematics. The award citation noted that Professor Borel's work "provided the empirical base for a great swath of modern mathematics, and his observations pointed out the structures and mechanisms that became central concerns of mathematical activity. In the course of amassing these astounding achievements," the award citation continued, "he placed the facilities of the Institute for Advanced Study at the service of mathematics and mathematicians, using them to foster talent, share his ideas, and facilitate access to recent developments through seminars and lectures. It is just simply not possible to cite a career more accomplished or fruitful or one more meaningful to the contemporary mathematical community."

A 1993 article in the *Notices of the American Mathematical Society* noted that Borel "has played an eminent role as stimulator and propagator of new ideas in the international mathematical community. In particular, he has repeatedly initiated and participated in seminars and summer programs where important new techniques and results were brought forth." Most recently, Armand Borel was the main organizer of the multi-year Summer Program at the Center of Mathematical Science at Zhejiang University, Hong Kong. Professor Borel spent four months in each of three academic years, from 1999-2001, at Zhejiang University in order to set up the program.

In these pages last year, I had the pleasure of announcing the January 2002 appointment of the art historian Kirk Varnedoe to the Faculty of the School of Historical Studies. We welcomed Kirk wholeheartedly to the Institute community, and it is with great sadness that I must now write that Kirk died on August 14, 2003, at the age of 57, after a long and valiant battle with cancer. We will miss his presence here very much. During his all-too-brief time at the Institute, Kirk focused much of his remarkable energy on lecturing widely, both in this country and abroad, on teaching, and on writing the fifty-second annual 2003 A.W. Mellon Lectures in the Fine Arts, which he delivered this spring, to overflow crowds, at the National Gallery of Art in Washington, D.C. He titled the series "Pictures of Nothing: Abstract Art since Pollock." The first lecture, "Why Abstract Art?," was followed by "Survivals and Fresh Starts," "Minimalism," "After Minimalism," "Satire, Irony, and Abstract Art," and "Abstract Art Now." As is traditional with the Mellon lectures, they will be published as a book.

The National Science Foundation has awarded the Institute for Advanced Study's School of Mathematics a $9 million grant, effective over a six-year period, to support the School's work as a mathematical center that integrates education with research. The School of Mathematics was the first of the world's continuously active mathematical

institutes, and other early mathematical institutes, such as the Institute des Hautes Etudes Scientifiques in Paris and the Max-Plank-Institut fur Mathematik in Bonn, took the Institute for Advanced Study as their model. For the past seventy years, the School of Mathematics has offered mathematical scholars research opportunities characterized by a rich mathematical environment with interesting new ideas and problems; a broad perspective that encompasses both pure and applied mathematics; excellent academic facilities; and minimal distractions, which permit scholars the concentration needed to develop a new approach, find new connections, or tackle a large problem.

We welcomed former Members to the Institute campus on April 4 and 5 for the AMIAS Biennial Conference. Four lectures were given in Wolfensohn Hall: "A Journey in the World of Differential Equations," by Jean Bourgain, Professor in the School of Mathematics; "Human Dissection and Vivisection: Science, Religion, and Politics in Ancient Greece," by Heinrich von Staden, Professor in the School of Mathematics; "Einstein's Legacy: A Quarter Century of The Collected Papers of Albert Einstein," by Diana Kormos-Buchwald, Associate Professor, Caltech, General Editor and Director, Einstein Papers Project (Member, School of Social Science, 1992-93); and "The Human Genome Project: Where Do We Go from Here?" by Arnold Levine, Visiting Professor in the School of Natural Sciences.

The School of Natural Sciences' "Prospects in Theoretical Physics" program completed its second year, and drew over 100 young physicists to the Institute campus from June 30-July 11 for a program titled "Cosmology, Particles, and Strings." Designed for advanced graduate students in physics and astrophysics, the program encourages the participation of women, minorities, and students from institutions with smaller programs in astrophysics and particle physics.

The School of Social Science completed its second year of a three-year focus on ethical issues, with discussion this year centered on the topic of corruption and its opposites: civic virtue, public responsibility, and bureaucratic rationality. Scholars from three disciplines - economics, political science, and anthropology - came together to examine a variety of questions from very different perspectives.

The Institute for Advanced Study has sponsored the IAS/Park City Mathematics Institute (PCMI) since 1994. PCMI is an integrated mathematics program that includes participation by, and interaction among, six different groups: research mathematicians, graduate students, undergraduate students, mathematics education researchers, undergraduate faculty, and high school teachers. The interaction among these diverse groups fosters a stronger sense of the mathematical enterprise as a whole, and raises awareness of the roles of professionals with varying responsibilities in mathematics-based professions. PCMI's flagship activity is its annual three-week Summer Session, attended this year by 260 participants and held June 29-July 19 in Park City, Utah. Additional programs take place throughout the year and include the year-long High School Teacher Program and the Lecture Publication Series.

During his five years as Head of the Institute for Advanced Study's Program in Theoretical Biology, from its inception in 1998 through the end of the 2003 academic year, Martin Nowak focused its research work on various aspects of mathematical biology. In July 2003, Dr. Nowak took up a new post at Harvard University as Professor of Mathe-

matics and of Biology, and founding Director of Harvard's new Institute for Theoretical Biology. During Arnold Levine's first year as Visiting Professor in the School of Natural Sciences and the Program in Theoretical Biology, he worked with a group whose research interests include genetics and genomics, polymorphisms and molecular aspects of evolution, signal transduction pathways and networks, stress responses and pharmacogenomics in cancer biology. Professor Levine initiated a series of regular meetings - consisting of presentations and discussion - for people interested in research in biology; fourteen were held during this past year in Bloomberg Hall. In addition, nine talks were presented during a special biology group meeting on December 9, 2002.

This year marked the 10th Anniversary of the Program for Women in Mathematics at the Institute for Advanced Study. The Program, whose research focus this year was mathematical biology, was held on the Institute campus from May 12-22. Sponsored by the Institute for Advanced Study and Princeton University, the program brings women students in contact with postdoctoral scholars and active professional mathematicians, and encourages women to further their mathematics education by offering deep mathematical content as well as extensive mentoring opportunities. To celebrate the 10th Anniversary, all past participants were invited to the Institute May 16-18, for a weekend of talks, research poster sessions, panels and social activities. Over the past ten years, hundreds of young women have participated in the program and gone on to successful and rewarding careers in mathematics. The field has been greatly enriched by their presence.

I am very pleased to announce that our Artist-in-Residence, composer Jon Magnussen, has been appointed to a new four-year term that will extend through the academic year 2006-07. A composer of music for the concert hall, drama, and dance, Magnussen also organizes the Institute's annual concert series and all related lectures and workshops. The tenth concert season included eleven performances in Wolfensohn Hall, including programs by vocal ensemble Fuma Sacra; fortepianist Malcolm Bilson, baritone Sanford Sylvan; and guitarist Antigoni Goni. Jon Magnussen presented two events in the "Talking About New Music" series in addition to pre-concert talks before each of the four concert programs. In progress, among other projects, is an American Ballet Theatre-commissioned orchestration of chamber works by Ernest Chausson (1855-99) for choreographer Robert Hill's new ballet based on Oscar Wilde's novel, *The Picture of Dorian Gray*. Magnussen will conduct the ABT orchestra when the work premieres on October 30, 2004, at New York City's City Center.

Thirteen/WNET New York's *Big Ideas*, the four-part public television series about some of the work that takes place at the Institute, featured several of our Faculty and Members in conversation with moderator Ira Flatow. The programs, titled "Exploring the Cosmos," "Einstein's Dream," "A New History of the World," and "Thinking Big," premiered in the New York/New Jersey/Connecticut area in April. The series was shown in over 45 markets across the country, with estimated audiences of over 450,000 individuals for each program. Thirteen maintains a *Big Ideas* website at www.Thirteen.org/bigideas, and videocassettes of the series are available. *Big Ideas* was made possible by the support of the Horace W. Goldsmith Foundation, Strachan and Vivian Donnelley, the Ambrose Monell Foundation, and Rosalind P. Walter. The Institute is deeply grateful to Trustee Robert B. Menschel, without whom *Big Ideas* would not have been possible, and expresses special thanks to Trustee Emeritus Ralph Hansmann for his support and encouragement of this project.

One of the great joys of my twelve years and a half as Director has been the opportunity to meet and learn from our very diverse group of Members and Visitors, the individuals who make the Institute such a rich and vibrant community. Judging by their enthusiastic year-end reports, what they take away from their experience here is every bit as valuable as what they leave behind. The Institute is shaped by their intellectual legacies, through remembered seminars and conversations, articles and books, that influence and inspire Faculty and fellow Members and are passed on to those who come after.

I personally have enjoyed an incomparable opportunity to interact substantively with colleagues on intellectual issues. And thanks to the richness and warmth of the extended Institute community, Taffy and I have been privileged to have a welcoming and supportive home. I look forward to a new role at the Institute as a member of the Faculty in the School of Mathematics, and to immersing myself more deeply in some interesting mathematical projects I've undertaken in recent months. I also will continue to be involved in efforts to build and strengthen the scientific communities of developing countries through the Millennium Science Initiative, and will be working on special projects for The Andrew W. Mellon Foundation.

I am proud to be handing over to my successor, Peter Goddard, the helm of a thriving institution. As the Institute moves through the uncharted waters of a new century, I am confident that under Peter's leadership it will continue to prosper by heeding the original Flexner vision - and by making the judicious course changes that will enable the Institute to continue to support and nurture this unique community of scholars.

Phillip A. Griffiths
Director

OFFICE OF THE DIRECTOR
RECORD OF EVENTS

The following is a calendar of events sponsored by the Office of the Director

Academic Year 2002-03

[illegible] 26
Member Family Barbecue

[illegible] 1
Playreading
The Little Foxes by Lillian Hellman

[illegible] 2
Talk sponsored by the School of Historical Studies
"Pope Pius XII and the Holocaust"
ROBERT WISTRICH, *Hebrew University, Jerusalem*

October 9
Talking About New Music
"Words and Music"
JON MAGNUSSEN, *Artist-in-Residence, Institute for Advanced Study*, STEVEN STUCKY, *composer*, and ANDREW MEGILL, *Fuma Sacra Artistic Director*

October 9, 11, and 13
Institute Concert Series
Pierre Certon *La, la, la je ne l'ose dire*; Giraut de Bornelh *Reis glorios*; Josquin Desprez *Mille regretz*; Orlando di Lasso *Bon jour, mon coeur*; Guillaume Dufay *Vergene bella*; Giovanni Giacomo Gastoldi *Tutti, venite armati*; Pietro Antonio Giramo *Festa, riso*; Robert Heppener *Canti carnascialeschi* (1966) (excerpts); Jon Magnussen *Occhi dolenti* (2002); Cipriano de Rore *Mia benigna fortuna*; Claudio Monteverdi *Zefiro torna e'l bel tempo rimena*; Pierre Passereau *Il est bel et bon*; Steven Stucky *Cradle Songs* (1996); and Augusta Read Thomas *Love Songs* (1997) (excerpts)
FUMA SACRA, *vocal ensemble*

October 18
Institute Film Series
The Navigator (1988)

October 23
Friends Fireside Chat
"It's Never Too Late"
ANNE MARTINDELL, *former Ambassador to New Zealand*

October 30
Institute Film Series
La Vie de Boheme (1992)

October 30
Friends Forum
"Holy War Before Globalization: The Pre-Modern Doctrine of Jihad"
PATRICIA CRONE, *Professor, School of Historical Studies*

November 1
Talking About New Music
"Four Psalms"
JOHN HARBISON, *composer and Institute Professor, Massachusetts Institute of Technology*

November 5
Playreading
Serious Money by Caryl Churchill

November 6
Institute Lecture
"The Missing Sentence: The Visual Arts and the Social Sciences in Mid-19th-Century Paris"
WOLF LEPENIES, *Visitor, School of Social Science*

November 13
Friends Forum
"Chance in Physics and Mathematics from the Botanist Brown to Financial Markets"
STEPHEN ADLER, *Professor, School of Natural Sciences*

November 15
Institute Film Series
RoGoPaG (1962)

November 20, 22, and 24
Institute Concert Series
Ludwig van Beethoven *Sonata in E-flat Major, Opus 7* (1796) and *Seven Bagatelles, Opus 33* (1802) and Franz Schubert *Sonata in F-sharp Minor, D. 571* (1817) and *Impromptu in F Minor, D. 935, Opus 142, No. 1* (1828)
MALCOLM BILSON, *fortepiano*

November 21
Institute Concert Series
Concert Lecture
"How To Read Urtext Editions And What, If Anything, Do Instruments Have To Do With It?"
MALCOLM BILSON, *Frederick J. Whiton Chair of Music, Cornell University*

November 26
Institute Film Series
Saint Clara (1996)

December 3
Playreading
Other People's Money by Jerry Sterner

December 4
Faculty/Colleague Dinner

December 8
Holiday Reception for Friends and Faculty

December 11
Institute Film Series
Three Penny Opera (1931)

December 12
Children's Holiday Celebration
THE GIVE & TAKE JUGGLERS

January 7
Playreading
All My Sons by Arthur Miller

January 10
Memorial service and reception for former Institute Director Dr. Harry Woolf

January 17
Institute Film Series
Daughters of the Dust (1991)

January 22
Institute Lecture
"Three Easy Pieces: Examples of Chaos in the Solar System"
PETER GOLDREICH, *Visiting Professor, School of Natural Sciences*

January 28
Institute Film Series
Blue Kite (1993)

January 30
AMIAS Lecture
"Project Orion"
FREEMAN DYSON, *Professor Emeritus, School of Natural Sciences* and GEORGE DYSON, *Director's Visitor*

February 3
Special Faculty Lecture
"Van Gogh's Postman: The Portraits of Joseph Roulin"
KIRK VARNEDOE, *Professor, School of Historical Studies*

February 4
Playreading
Professional Skepticism by James Rasheed

February 5
Institute Film Series
The Golden Coach (1952)

February 12
Institute Concert Series
Gabriel Fauré *Cinq melodies "de Venise"*; Hugo Wolf *Three Songs on Texts of Michelangelo* and *Poems of Mörike*; Pyotr Ilyich Tchaikovsky selected songs; and Jon Magnussen *Psalm 21*
SANFORD SYLVAN, *baritone* and DAVID BREITMAN, *piano*

February 13
Dinner for new Friends of the Institute
Institute Concert Series
Concert Discussion
JON MAGNUSSEN, *Artist-in-Residence, Institute for Advanced Study*, SANFORD SYLVAN, *baritone*, and DAVID BREITMAN, *piano*

February 14
Institute Concert Series
Franz Schubert *Die Winterreise, Opus 89*
SCOTT MCCOY, *tenor* and DAVID BREITMAN, *piano*

February 19
Friends Forum
"The Incumbent Protection Act of 2002: Politics Under the New Campaign Finance Law"
W. MICHAEL JOHNSTON, *Member, School of Social Science*

February 20
Institute Film Series
La Chienne (1931)

February 22
Midwinter Party

February 24
Lecture Series in Biology: "Science, Anxiety, and Meaning: Biomedicine Encounters Ethics and Public Policy"
HAROLD T. SHAPIRO, *Princeton University*

February 26
Institute Lecture
"The Nanjing Massacre and Chinese Historical Memory"
JOSHUA FOGEL, *Two-Year Mellon Visiting Professor, School of Historical Studies*

March 2
Event for prospective Friends
"Grand Pursuit: In Search of 20th Century Economic Thinkers"
SYLVIA NASAK, *Director's Visitor*

March 4
Playreading
Old Money by Wendy Wasserstein

March 5
Institute Film Series
Wedding in Galilee (1987)

March 6
AMIAS Lecture
"Von Neumann's Universe: 1903-2003"
GEORGE DYSON

March 11
Dinner for members of the Director's and Chairman's Circles
"Issues Museums Face Today"
ROBERT ANDERSON, *Member, School of Historical Studies*

March 16
Institute Trip
Museum of Modern Art

March 26, 28, and 30
Institute Concert Series
Leo Brouwer *El Decamerón Negro*; Agustín Barrios-Mangoré *Three Pieces*; Joaquín Rodrigo *Invocación y danza*; Sergio Assad *Three Greek Letters*; Federico Mompou *Suite Compostelana*; and Alberto Ginastera *Sonata, Opus 47*
ANTIGONI GONI, *guitar*

March 27
Institute Concert Series
Concert Discussion
JON MAGNUSSEN, *Artist-in-Residence, Institute for Advanced Study* and ANTIGONI GONI, *guitar*

April 4
AMIAS Conference

Institute Lecture
"A Journey in the World of Differential Equations"
JEAN BOURGAIN, *Professor, School of Mathematics*

Thirteen/WNET New York "BIG IDEAS" Showing: Episode One "Exploring the Cosmos." Is there life on other planets? Will humans colonize Mars? What happens when a large star runs out of fuel?

April 5
AMIAS Conference
"Human Dissection and Vivisection: Science, Religion, and Politics in Ancient Greece"
HEINRICH VON STADEN, *Professor, School of Historical Studies*
"Einstein's Legacy: A Quarter Century of The Collected Papers of Albert Einstein"
DIANA KORMOS-BUCHWALD, *Associate Professor, California Institute of Technology; General Editor and Director, Einstein Papers Project; Member, School of Social Science, 1992-93*
"The Human Genome Project: Where Do We Go from Here?"
ARNOLD LEVINE, *Visiting Professor, School of Natural Sciences*

April 8
Playreading
Mrs. Warren's Profession by George Bernard Shaw

April 13
Friends Fireside Chat
"A Career in Human Genetics"
LEON E. ROSENBERG, M.D.

April 14
Thirteen/WNET New York "BIG IDEAS" Showing: Episode Two "Einstein's Dream." Einstein spent his last 30 years searching for a unified theory to explain the universe, but didn't succeed. Has one been found in string theory?

April 19
Children's Easter Egg Hunt

April 23
Faculty/Colleague Dinner

April 26
Institute Trip
American Museum of Natural History

April 28
Thirteen/WNET New York "BIG IDEAS" Showing: Episode Three "A New History of the World." Is there such a thing as a just war? Is terrorism ever morally acceptable? Can ancient art change our current view of history?

May 2
Institute Lecture
"War and Moral Judgment"
MICHAEL WALZER, *Professor, School of Social Science*

May 3
Institute Trip
Limón Dance Company, New York, N.Y.

May 5
Thirteen/WNET New York "BIG IDEAS" Showing: Episode Four "Thinking Big." From diamond-toothed, garbage-eating turtles to the origins of language to Balinese cockfights, listen to great minds talk about their big ideas.

May 6
Playreading
Loot by Joe Orton

May 28
Friends Annual Meeting and Picnic

July 9
Institute Trip
Museum of Modern Art

"The Institute has provided the ideal environment for nurturing my project, for it is a place rich both in scholarly resources and in intellectual support and camaraderie. My Membership has been invaluable, and I thank you from the heart for giving me the opportunity to live and work here."

—Member, School of Historical Studies

The terrace at the back of Fuld Hall, looking towards the pond and the Institute Woods

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The Institute for Advanced Study expresses deep appreciation for all gifts and grants to its endowment and capital funds, for annual operating support, and for in-kind contributions in fiscal year 2003.

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West Building, home of the School of Historical Studies and the School of Social Science

THE SCHOOL OF HISTORICAL STUDIES

Faculty

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GILES CONSTABLE (*through 12-31-02*)
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The School of Historical Studies is concerned principally with the history of Western European, Near Eastern, and East Asian civilizations. Both inside and outside these broad areas of study Faculty and Members have pursued a wide range of topics. The emphasis has been traditionally strong in the fields of Greek and Roman civilization, Western Medieval history, early modern and modern European history, but over time the School's interests have been enlarged to include Islamic culture, the history of China and Japan; international relations, the history of art, science, and ideas, and more recently; music studies. Well over one thousand Members have come to the School since its foundation, and their work here in these and other areas of research has regularly been enriched by the fruitful interaction of disciplines in a small and collegial community.

The various fields represented by the School are a product of its own history. Two years after the opening of the School of Mathematics in 1933, a School of Economics and Politics and a School of Humanistic Studies were established. In Humanistic Studies, the first professor, Benjamin Dean Meritt, a specialist in Greek epigraphy, was closely associated with excavations in the Athenian Agora. The second appointment to the Faculty of the School of Humanistic Studies was that of the German art historian Erwin Panofsky.

*The School was deeply saddened by the death of Kirk Varnedoe from cancer on August 14, 2003. Although he served at the Institute only a year and a half, Professor Varnedoe seemed to pack a lifetime of erudition, eloquence and energy into that brief time. This is reflected below in his report on his activities in his final academic year. His legacy is enormous and he is deeply missed.

Panofsky's work ranged across European art from the Middle Ages to motion pictures, but he was most closely associated with the development of the field of iconology.

Three additional appointments strengthened the field of classical and Near Eastern studies: Elias Avery Lowe, a Latin palaeographer; Ernst Herzfeld, a Near Eastern archaeologist, and Hetty Goldman, a pioneering woman archaeologist, who worked at Tarsus in Turkey. Modern history was represented at the Institute from the outset with the appointment of the military and political historian Edward M. Earle. Earle was an original member of the School of Economics and Politics, which merged in 1949 with the School of Humanistic Studies to become the School of Historical Studies.

After World War II, classical studies were further augmented by the appointments of Homer A. Thompson in Greek archaeology, Harold F. Cherniss in Greek philosophy, and Andrew Alföldi in Roman history and numismatics. Medieval history came to the Institute Faculty with Ernst Kantorowicz, whose interests ranged in time from the later phases of classical antiquity to the sixteenth century. The art historical tradition was taken over from Panofsky by Millard Meiss, who completed his work on Burgundian manuscript painting during his years at the Institute.

Additional fields came with the appointments of Sir Ernest Llewelyn Woodward in diplomatic history, James F. Gilliam in Roman military history and papyrology, Kenneth M. Setton in medieval relations between the Papacy and the Levant, and Felix Gilbert in Renaissance as well as modern German history. A new term professorship in honor of George F. Kennan brought Jack F. Matlock, Jr. to the School as the first Kennan professor in international relations. Many of the major scholars who came to the Institute in the decades after World War II are still active in School affairs. These are the current faculty and emeriti, whose reports appear below. Their work illustrates the School's continued dedication to fields of historical inquiry that it has long supported, while maintaining an ongoing openness to new areas as reflected in the School's support over the past several years of a series of term-appointments at the faculty level in the field of East Asian history. Recognizing the value this new perspective brought to the range of study within the School led to the decision to seek a permanent appointment in the field, which will be taken up in the coming academic year by Professor Nicola Di Cosmo. As in the past, the School will continue in the years to come to encourage the exploration or creation of new fields of historical inquiry and the breaking down of traditional academic boundaries.

ACADEMIC ACTIVITIES

FACULTY

PROFESSOR GLEN BOWERSOCK participated in numerous symposia and conferences in the course of the past academic year. In the autumn of 2002, he spoke on the Jewish kingdom of South Arabia in late antiquity at a symposium in Rome under the joint auspices of the Istituto Italiano per l'Africa e l'Oriente and the Accademia dei Lincei. A few weeks later, he delivered a paper on cults of the Highest God for a colloquium in Bordeaux on the Black Sea in antiquity. At the Toronto meetings of the American Society of Biblical Literature and the American Schools of Oriental Research, Professor Bowersock gave a paper on Nabataean onomastics and responded to a panel discussion of his book, *Martyrdom and Rome*. In the spring of 2003, at a conference in

Catania devoted to the work of M. I. Rostovtzeff, he spoke on the historian's little known book, published in Petrograd in 1918, on the birth of the Roman Empire. He later went to Heidelberg to speak on Artemidorus' Dream Book at a conference on the Second Sophistic, and to Pisa to give two seminars at the Scuola Normale Superiore – one on Augustan Athens, the other on the first basilica of St. Peter in Rome. Finally, he gave the inaugural lectures, on continuity and discontinuity in history, for the newly established Istituto di Studi Umanistici in Florence.

Professor Bowersock returned to Helsinki, along with former Institute member Alan Bowman of Oxford, to continue work on an advisory committee for the Academy of Finland with responsibility for supervising the work of a Finnish team of archaeologists and papyrologists at Petra in Jordan and a Finnish project for cataloguing the library of the Patriarchate of Alexandria. He also continued as a member of the *consiglio scientifico* of the Istituto in Florence and of the editorial committees of several journals. He supervised arrangements for cataloguing the archive of Louis Robert, of which he is in charge, at the Institut de France in Paris, and he went to Paris to work out procedures for access to the archive and publication of its *inedita*. Professor Bowersock also joined a group of scholars to introduce the Metropolitan Opera's new production of Berlioz's opera *Les Troyens* through a symposium in New York, at which he lectured on Berlioz's use of Virgil's *Aeneid*. His publications in the past academic year included articles on philosophy in the Second Sophistic, central Syria in late antiquity, the historian Zosimus, and Edward Gibbon, as well as several reviews for the general public. In the Italian journal *Rivista Storica Italiana*, he added a response to several papers, published there, about his work on late antiquity.

PROFESSOR CAROLINE WALKER BYNUM spent the fall of 2002 at the American Academy in Berlin, where she did research on fifteenth-century cult sites in Mecklenburg and Brandenburg. She joined the faculty of the Institute in January 2003 and has spent much of the spring learning her new environment. In 2002-03, she published an article on violent imagery in late medieval piety and one on the cult of the blood of Christ – both articles adumbrating the themes of the book on blood piety that continues to be her major research project. She also published (with her student Susan Kramer) an article on the issue of twelfth-century individualism that she first discussed twenty years ago. Two essays on topics not strictly speaking medieval appeared in the journal *Common Knowledge*. She wrote two book reviews, a long encyclopedia article on soul and body in the Middle Ages, an article on gender in the writings of Gertrude of Helfta, and an essay for an Oxford University Press volume on medieval soteriology. She gave lectures in Berlin, Muenster, Frankfurt, Helfta, Poznan, Jerusalem, New York (The Woodrow Wilson Foundation), London (The Victoria and Albert Museum), Cambridge Mass. (The Radcliffe Institute), and spoke at a workshop in Leeds, England, organized around her essay "Wonder," published in the *American Historical Review* in 1997. She continued to work with Columbia University dissertation students and, in spring 2003, held an informal reading class for Columbia graduate students preparing for oral exams. She serves on the Board of the National Humanities Center and on the Selection Committee for the Yad-Hanadiv Foundation in Jerusalem, and is a mentor for the German Historical Institute Transatlantic Seminar for German and American Doctoral Students.

PROFESSOR PATRICIA CRONE sent her book on medieval Islamic political thought to press and completed three articles. One of her articles in press appeared. So too did an unauthorized Arabic translation, by a Syrian intellectual, of her first book, written with

Michael Cook, which is somewhat unfortunate, given the current political situation. She delivered lectures at McGill and the Institute in November, taught a graduate seminar on the impact of the Turkish invasions on Islamic culture at the University of Pennsylvania in the spring semester, acted as discussant at two conferences at the same university, one on the Koran in February and another on medieval Islamic thought in March, contributed a paper to a conference on toleration in medieval Islam at New York University in May, and organized her own conference on the Greek strand in medieval Islamic thought at the Institute in June. As in previous years, she ran two seminars at the Institute, one the time-honored Islamicist seminar and the other a new 'empire group'. Both her conference and her empire group were interdisciplinary, both were international, and both were based on the rule that no papers could be read in the proceedings, so that the gatherings could be used entirely for discussions (which is not as easily achieved as it sounds). But the participants in the empire group were mostly members of the Institute who proved to have an interest in the behavior of empires, whereas the participants in the conference were Islamicists supplemented by classicists, Syriacists, and European medievalists who were specially brought in from diverse parts of the world (Britain, Germany, France, Italy, Lebanon, Morocco, and the States), and whereas the empire group operated without formal papers, the conference was based on formal papers submitted in advance and selections of texts for reading and/or discussion in specially appointed text sessions (an innovation that worked better at some times than at others). Crone also continued to commission titles for her new series, "Makers of the Muslim World", to be published by Oneworld, for which the first manuscripts began to arrive over the summer.

PROFESSOR JOSÉ CUTILEIRO lectured at Le Centre Européen de la Culture and at the Department of Political Science of the University of Geneva on European defense and security. He took part in the Seventh Arrábida Meeting, chaired by Lord Carrington, on transatlantic relations, European institutional architecture, and Iraq and the West after the war, held in Arrábida, Portugal. He participated in meetings of the International Institute of Strategic Studies (Washington). He published a book on the Yugoslav crisis of the 1990s: *Vida e Morte dos Outros – A comunidade internacional e o fim da Jugoslávia*, Imprensa de Ciências Sociais, Universidade de Lisboa, 2003; and two articles "A Bósnia-Herzegovina revisitada – A propósito do livro de Brendan Simms, 'Unfinest Hour'", in *Política Internacional*, no. 26, Fall-Winter, 2002 and "O Alto Comissariado das Nações Unidas para os Direitos do Homem" in *Nação e Defesa*, no. 104, Spring, 2003. He is preparing an expanded English version of the Yugoslav book and continues working on the general question of humanitarian intervention. To pursue his research, he has traveled to Belgium, Britain, France, Portugal, and Switzerland. He is a member of the Steering Committee of the Arrábida Meetings, a co-director of the Arrábida Conflict Prevention Initiative, Lisbon, and a member of the Council of International Advisors of the Conflict Management Group, Cambridge, Mass. He kept a regular column of international affairs commentary in *Expresso*, the most prestigious Portuguese weekly. As Special Representative of the United Nations Commission on Human Rights for Bosnia-Herzegovina and the Federal Republic of Yugoslavia, he visited each of these two countries twice, in November of 2002 and March of 2003. He presented the reports of his field missions to the Commission's plenary session in Geneva in March 2003.

He organized the following two lectures at the Institute:
December 9, 2002
'A European (British) View of the Struggle against Terrorism'
GENERAL LORD GUTHRIE, Former UK Chief of Defense Staff

March 5, 2003
'American Foreign Policy in an Age of Preeminence'
STROBE TALBOTT, President, Brookings Institution

Several volumes edited by PROFESSOR JOSHUA FOGEL are due to appear later this year. Based on an international conference supported by both the Japan Foundation and the Chiang Ching-kuo Foundation, the eleven essays in "The Role of Japan in Liang Qichao's Introduction of Modern Western Civilization to China," edited by Fogel and to be published by the Institute of East Asian Studies, University of California, Berkeley, take up various aspects of the life and work of Liang Qichao (1873-1929), the most important Chinese journalist-publicist-intellectual of the late nineteenth and early twentieth centuries. Liang provides a window onto the immense impact Japan and Japan-as-a-conduit-for-things-Western had on China at this time. The product of an international conference held in Santa Barbara, Calif. in 1999, "Late Qing China and Meiji Japan: Political and Cultural Aspects of Their Interactions" (also edited by Fogel), will be published by East Bridge Press. It is comprised of eight scholarly essays concerned with Sino-Japanese political and cultural interactions in the late nineteenth and early twentieth centuries. Fogel penned the introductions to both volumes, respectively: "Liang Qichao and Japan" and "Integrating Late Qing China and Meiji Japan." He also translated or co-translated four of the essays for the former volume (two from Chinese and two from Japanese).

Fogel also recently completed a draft translation of a massive historical novel, Chronicle of the Tatar Whirlwind: A Novel of Seventeenth-Century East Asia, by Shiba Ryōtarō. The novel concerns the background to the Manchu conquest of China in 1644 by following the fictitious lives of a Japanese and a Manchu woman who find themselves in countless theaters over the course of the two decades or more leading up to that dramatic event. It will be published by Kodansha International as part of a series of translations from the voluminous works of Shiba Ryōtarō (1923-96), the great historical novelist.

"An Important Japanese Source for Chinese Business History" is a short essay Fogel wrote for the newsletter *Chinese Business History* (vol. 12.2, Fall 2002). It introduces a little known source, a Japanese newspaper published in the mid-1880s in Shanghai. His piece, "Naitō Konan (1866-1934) and Chinese Historiography," appeared in the inaugural issue of *Historiography: East and West* (2003). It examines the views on Chinese historiography of the great Japanese sinologist, Naitō Konan. This journal is completely on-line with articles appearing in a host of languages and summaries in English and Chinese.

For volume 15 (2003) of the journal he founded in 1988, *Sino-Japanese Studies*, Fogel translated an essay entitled "Asian Female Sovereigns and the Empress Wu," by Araki Toshio. This essay examines the extraordinary phenomenon of the many women who ruled in East Asian countries: Japan, Korea, China, and a mysterious Southeast Asian land known only in Chinese sources as "Dongnü guo" (Country of the Eastern Women), from the late sixth through the late eighth centuries.

The conference he organized at the Institute in February 2002 on the theme of "How Did 'China' Become China and How Did 'Japan' Become Japan: The Teleologies of the Modern Nation-State," has since been edited and accepted for publication by the University of Pennsylvania Press. Fogel wrote the introductory essay (from his keynote address at the conference), entitled "The Teleology of the Nation-State."

Over the course of the year, 2002-03, Fogel gave a number of scholarly talks. These included an analysis of Japanese historical fiction and its translation (at both the East Asian Studies Seminar, IAS, in October 2002, and at a conference in Banff in November 2002). More closely attuned to his present research on the emergence and development of the Japanese community of Shanghai in the nineteenth century were several talks he gave on the subject of "Prostitutes and Painters: Early Japanese Migrants to Shanghai" (at the Shelby Cullom Davis Center Colloquium, Princeton University, November 8, 2002; at the Luce Center, Yale University, January 31, 2003; and at Ohio State University, May 7, 2003). On February 26, 2003, he delivered the annual Faculty Lecture for the School of Historical Studies, entitled "The Nanjing Massacre and Chinese Historical Memory."

In February 2003, Fogel organized a conference, again supported by the Andrew J. Mellon Foundation, entitled "Is It Really Like Kissing through a Handkerchief? Reading and Translation from Chinese and Japanese." He gave the keynote address: "On the Tasks of the Translator." The participants included: David Knechtges (University of Washington), Thomas Hare (Princeton University), Patrick Hanan (Harvard University), Perry Link (Princeton University), John Nathan (University of California, Santa Barbara), Jay Rubin (Harvard University), and Laurence Venuti (Temple University). Serving as discussants were three Institute Members in East Asian studies: Martin Kern, Joachim Kurtz, and Hu Ying; and Janet Walker (Rutgers University).

As he had in 2001-02, in 2002-03 Fogel organized and led the East Asian Studies Seminar at the Institute.

During the academic year 2002-03, PROFESSOR JONATHAN ISRAEL continued with his long-term project on the origins and history of the European Radical Enlightenment. Besides research in libraries and archives in London, The Netherlands, and Greece, he has been examining rare printed materials preserved today in the rare book collections at Princeton, Yale, Columbia, and at the Library of Congress, in Washington. He gave a talk on the present state of his research to the History Department at Princeton University on 3 December. At the same time, he has continued contributing to the current debate on the subject of diasporas. His latest book, *Diasporas Within a Diaspora. Jews, Crypto-Jews and the World Maritime Empires (1540-1740)*, a study of the trans-Atlantic network of Western Sephardic communities between the sixteenth and eighteenth centuries, was published by E.J. Brill, of Leiden, in August 2002.

The idea of 'a radical Enlightenment' as the origin of modern ideas of equality, democracy, and freedom of the individual was the topic of a special session of the 26th annual conference of the Northeast American Society for Eighteenth-Century Studies (NEASECS), held at the City University of New York, in October 2002. Panel discussions of the main themes of the book were also held at the University of Venice, in November 2002, at the Technical University of Athens in April 2003, and at both the University of Groningen and the Institute of Historical Research, in London, in May.

On 11 and 12 November, Professor Israel spoke on the 'Radical Enlightenment' first to a general and, then, to a more specialized group at Wesleyan University. On 22 November, he gave a paper on 'Vico and the Radical Enlightenment', at the international Vico conference held at the Fondazione Cini, in Venice, and on 20 March presented a paper on the 'Seventeenth-century Origins of Modern Democratic Republicanism' to the History of Political Thought Seminar, at Columbia University. He also spoke on the 'Rise of

History of Philosophy', at the international conference on the Teaching of History of Philosophy held at Princeton University on 4 and 5 April 2003. He gave speeches on the career of the famous British scholar Charles Boxer, at the conference held in the latter's memory, at Yale, in November, and, on 24 March, on the career of the bibliographer Anna Simoni, at the Dutch Embassy, in London. On 20 May, he delivered the 2003 annual 'Town and Gown' lecture of the city and University of Groningen, in The Netherlands, speaking about Groningen as a regional culture of the Dutch Golden Age. On 20 June, he held a half-day 'master-class' session discussing the research dissertations of a group of Amsterdam graduate students researching on aspects of early modern intellectual history and, the following day, gave a short 'inaugural' lecture on the Radical Enlightenment at the ceremony of induction as an honorary professor of the University of Amsterdam. Also in June, he attended the annual meetings of the curatorium of the Huizinga Institute for Cultural History, in Amsterdam and the UCL Committee for the Promotion of Low Countries Studies, attended by the Dutch and Belgian ambassadors, and other representatives from the Low Countries, in London.

His shorter publications this year were: "Heinsius, Dutch *Raison d'État*, and the Reshaping of the Baltic and Eastern Europe", in J.A.F. de Jongste and A.J. Veenendaal (eds.) *Anthonie Heinsius and the Dutch Republic, 1688-1720* (The Hague, 2002), pp. 25-44; "Dutch History from the Perspective of World History" in *Over de grenzen van de Nederlandse Geschiedenis. Jubileumsymposium van het Instituut voor Nederlandse Geschiedenis 19 April 2002* (The Hague, 2002), pp. 25-33; "The Dutch Republic and the Silesian Revolt against the Habsburgs (1618-1625)," in M. Kapustka, A Koziel, and Piotr Oszczanowski (eds.) *Netherlandism in Silesia and Neighbouring Countries*, (Wroclaw, 2002) pp. 18-24; and the 'Teylers Lecture on Radical Enlightenment' in *Mededelingen van de Stichting Jacob Campo Weyerman* (Haarlem) xxvi (2003), pp. 4-9. In addition, there were several book reviews.

PROFESSOR KIRK VARNEDOE taught a seminar in the autumn semester at The Institute of Fine Arts of New York University, on Abstract Art Since Jackson Pollock. He also lectured extensively in the New York Area and around the country: In October, he delivered: the John I. K. Baur Distinguished Scholar in American Art lecture at the Katonah, N.Y. Museum of Art, on "Jackson Pollock and his Consequences;" the inaugural lecture, on creative processes in modern art, of a benefit drive in support of the PBS series on contemporary artists, ART21, at the auction room of Philips, de Pury, and Luxembourg, in New York City; a talk on Van Gogh's portraits of the Arles postman Joseph Roulin, at the Telfair Museum in Savannah, Georgia; a lecture entitled "Gauguin's Truthful Lies," at the Metropolitan Museum of Art in New York; an analysis of the work of the contemporary artist Janine Antoni at Site Santa Fe in Santa Fe, New Mexico; and a focused examination on one Picasso collage, "Picasso's 'Guitar and Wine Glass' in Context," at the Marian Koogler McNay Museum in San Antonio, Texas. In November, he continued by giving: a lecture on "Instinct and Intelligence in Modern Art," in the context of the Chicago Humanities Festival, at the Art Institute of Chicago; the third annual Rembrandt Lecture at the Rijksmuseum in Amsterdam, on the subject of private versus public patronage in the American and European museum systems; and a more informal talk to the curatorial staff of the Van Gogh Museum in Amsterdam. Additionally, Professor Varnedoe was asked to speak on the subject of memorial sculptures in modern art, to a meeting of the special Advisory Council appointed by The Lower Manhattan Development Corporation to consider the terms of an appropriate memorial

commemorating the events of September 11, 2001. Also in November, he published an essay on the artist Chuck Close in the catalogue of Close's exhibition at the Pace-Wildenstein Gallery in Chelsea. In December, he gave the principal address for the meeting of the American Academy of Arts and Science, at The Rockefeller University in New York City, on "Matisse, Picasso, and the Idea of Influence." In January of 2003, Professor Varnedoe delivered two lectures, on Scandinavian art and on Gustave Caillebotte, at Augustana College in Illinois, and worked on the installation – at The Museum of Modern Art's temporary facility in Queens, N.Y. – of the internationally acclaimed exhibition "Matisse/Picasso." He was one of a six-member team of curators from London, Paris, and New York who had organized the exhibition and wrote its catalogue. Immediately following the opening of the show in Queens in February, he lectured on the exhibition, in the first annual Elsen Memorial Lecture, at The Society of the Four Arts in Palm Beach, FL. Along with co-curator John Elderfield, he also taped an hour-long interview about the exhibition, aired on the Charlie Rose show on PBS in May, an interview with Morley Safer for the CBS Sunday Morning program, and a briefer segment with Michael Kimmelman for the Arts and Entertainment network. The principal event of the spring of 2003, for Professor Varnedoe, was the series of six Mellon Lectures, at the National Gallery of Art in Washington. Under the general title "Pictures of Nothing: Abstract Art Since Jackson Pollock," the lectures were delivered every Sunday afternoon, for the three weeks preceding Easter and the three weeks following, concluding on May 11. As is traditional with the Mellon Lectures, these talks will, after revision and editing, be published as a book. Professor Varnedoe also continued to serve on several boards, advisory councils, and selection committees, attached to institutions including The Nasher Sculpture Center in Dallas, the Japan Society in New York, The National Humanities Center in North Carolina, the Princeton University Art Museum, the Center for Scholars and Writers of the New York Public Library, and the Praemium Imperiale.

PROFESSOR HEINRICH von STADEN contributed a paper on the ancient Greeks' therapeutic uses of sexual abstinence and sexual intercourse to an international conference on Hippocratic medicine at the University of Newcastle in August 2002. In early October 2002, he gave a lecture ("A Small Epilepsy") on further aspects of this topic at the Institute of the History of Science, Medicine, and Technology of The Johns Hopkins University at a symposium honoring the late Owsei Temkin. In mid-October, he gave a lecture ("Galen on Alexandria and Egypt") at a conference on Alexandria at the Center for the Ancient Mediterranean, Columbia University, as well as the Samuel X. Radbill Lecture on "To Help or Not to Harm: Ethics in the Hippocratic Writings" at the College of Physicians in Philadelphia. In late October, he lectured at Indiana University (Department of Classics) on Hellenistic anatomy. In early November 2002, he gave a lecture at Franklin and Marshall College (Department of Classics) on the Hippocratic *Oath*. In mid-November, he contributed a paper on Galen ("Le daimon de Galien") to a symposium on "Rationnel et irrationnel dans la médecine antique et médiévale" at the Centre Jean Palerne, Université de Saint-Étienne. In December 2002, he served as a commentator at a symposium on "Global Science and Comparative History: Jesuits, Science, and Philology in China and Europe, 1550-1850" at Princeton University (Program in the History of Science and the Shelby Cullom Davis Center). In February 2003, he lectured at Trinity College, Hartford, on "Health as a Moral and Non-Moral Concept: Greek and Roman Perspectives" at a conference on "The Meanings of Health." In early April 2003, he gave a lecture at the biennial conference of the Association of Members of the Institute for Advanced Study ("Human Dissection and Vivisection:

Science, Religion, and Politics in Ancient Greece"). In late April, he gave the Rothschild Lecture at Harvard University (Department of the History of Science) on ancient Greek moral, social, and epistemological responses to the inevitability of error and failure in the practice of medicine. In early May, he participated in the annual meeting of the American Association for the History of Medicine in Boston. In mid-May, he lectured at McGill University, Department of Social Studies of Medicine, on "Souls, Nerves, and Machines in Hellenistic Medicine" at a symposium in honor of the late Don Bates.

In March 2003, Professor von Staden was elected a Corresponding Member of the Akademie der Wissenschaften in Göttingen. His publications in the academic year 2002-03 included: "*Hos epi to poly*: 'Hippocrates' Between Generalization and Individualization", in *Le normal et le pathologique dans la Collection hippocratique. Actes du Xème Colloque International Hippocratique*, ed. Antoine Thivel and Arnaud. Zucker (Nice, 2002) pp. 23-43; "Division, Dissection, and Specialization: Galen's *On the Parts of the Medical Techne*", in *The Unknown Galen*, ed. Vivian Nutton (*Bulletin of the Institute of Classical Studies*, London, Supplement 77, 2002), pp. 19-45; "L'Œil d'après Hérophile, Démosthène Philaléthès et Aglaias de Byzance", in *Autour de l'œil dans l'Antiquité. Approche pluridisciplinaire. Table ronde de Lons-le-Saunier*, ed. (Lons-le-Saunier, 2003), pp. 83-93; "A Woman Does Not Become Ambidextrous: Galen and the Culture of Scientific Commentary", in *The Classical Commentary. Histories, Practices, Theory*, ed. Roy K. Gibson and Christina Shuttleworth Kraus (Leiden, 2002), pp. 109-139. He continued serving on the editorial boards of several professional journals.

PROFESSORS EMERITI

PROFESSOR MARSHALL CLAGETT, while continuing the preparation of the fourth and last volume of his *Ancient Egyptian Science*, also continued his new studies of the *Liber Calculationum* of the fourteenth-century philosopher and logician, Richard Swineshead of Merton College, Oxford. Furthermore, he continued serving on editorial boards of journals in the history of science.

During the academic year 2002-03, GILES CONSTABLE published a revised edition of the *Libellus de diversis ordinibus et professionibus qui sunt in aecclesia* (Oxford, 2002) and two articles: "Individualism and Institutions in Medieval Religious Communities" and "The Three Lives of Odo Arpinus: Viscount of Bourges, Crusader, Monk of Cluny". He published a memoir of Steven Runciman and another (in collaboration with Alan Bernstein and William Courtenay) of Heiko Oberman, and prefaces to two volumes. He gave the keynote address at conferences in Admont (Austria), Claremont, and Florence; spoke at a conference in Auxerre; served as Lansdowne Lecturer at the University of Victoria; and lectured at Lawrence University (Appleton, Wisconsin), Rutgers University, and Cornell University. He attended (without speaking) several conferences, including the annual medieval congress at Kalamazoo.

PROFESSOR OLEG GRABAR taught a seminar on "The Holy and the Sacred in Islamic Art" at the University of Pennsylvania. He lectured on Persian painting at the Los Angeles County Museum, Brown University, and the University of Michigan; on Islam and icons or images at the Louvre in Paris and Princeton University, where he gave the annual Helen Seeger lecture; and on Islamic art and the West at Dartmouth College. He gave a communication at the Académie des Inscriptions et Belles-Lettres in Paris on

"Portraits of Prophets," and participated in colloquia at the Doris Duke Foundation in Honolulu on the state of the field of Islamic art, at UNESCO in Paris on the protection of monuments, and at La Tourette in France on sacred spaces. He was on the juries of doctoral dissertations at the University of Lausanne and the Ecole des Hautes Etudes in Paris. He received the honorary degree of Doctor of Humane Letters at the University of Michigan and was made an honorary member of the Middle East Studies Association and of Middle Eastern Medievalists. He also co-edited an issue of *RES* devoted to Islamic art.

The following is a list of his publications which appeared during the year: "About a Bronze Bird," in E. Sears and Thelma K. Thomas, *Reading Medieval Images* (Ann Arbor, 2002), pp. 117-25; "Rêves d'empire dans le monde de l'Islam," Olga Weber ed., *Les Civilisations dans le regard de l'autre* (UNESCO, Paris, 2002), pp. 153-160; "Foreword and Comments," A. Petruccioli and Kh. K. Pirani, *Understanding Islamic Architecture* (London, 2002), pp. IX-X, 8, 48; "Reflections on Qajar Art and its Significance," *Iranian Studies*, 34 (2001), 183-186; and "What should one know about Islamic Art," *RES* 43 (2003), 5-11.

PROFESSOR CHRISTIAN HABICHT attended an international symposium on Ludwig Ross, the first general director of antiquities in Greece (1834-36) and first professor of archaeology at the University of Athens (1837-43), an event jointly sponsored by this University and the local German Archaeological Institute. He spoke on Ross as an epigraphist. The Institute's director introduced him to the spectacular new finds from spring 2002 at the Kerameikos: the *kouros* by the "Dipylon master" of ca. 600 B.C. and the other major sculptures found with it. From Athens, he went to Rhodes, since he was working on a major Rhodian topic; he visited the sites and museums and talked to the authorities in charge of the Archaeological Service.

In November, he presented a seminar at Berkeley on "Greek Festivals Neglected." He declined two other invitations: to deliver the keynote address at a conference on "Rome and Achaia: Greek Culture and Roman Society" (University of Missouri, Columbia), and to attend a symposium at La Corũna, Spain, on "La figura del principe heredero en época helenistica", but agreed to contribute a paper on the Attalid monarchy, to be read and included in the Proceedings.

At the invitation of the University of Hamburg, he gave in May the main speech at a memorial for Peter Herrmann, a close colleague and friend who had been his fellow student since 1950 and was his most active correspondent ever since (the deceased had twice been a member of the School of Historical Studies). Habicht also wrote his obituary, to appear in *Gnomon*.

He worked during the year on the chronology of the eponymous magistrates of Rhodes. Several hundreds are known for the Hellenistic period, most from amphora stamps, some fifty from inscriptions on stone. As in previous years, he spent much time preparing, with the assistance of Julia Bernheim, the inventory of the Institute's collection of squeezes of Greek inscriptions, some 25,000. The work resulted this spring in a CD-ROM which was distributed to interested parties in the U.S. and abroad. He continued to serve on the Committee for the award of the Jefferson Medal of the American Philosophical Society.

His publications were: "Ein Spartaner namens Sybariades?" *Hyperboreus* 8, 2002;

"Weitere Weihungen Geretteter," *Hyperboreus* 8, 2002. A large number of accepted papers still await publication.

PROFESSOR GEORGE KENNAN, now in his 100th year of age, enjoys himself, when strength permits, by reading literature, historical and other, which he should have read, but did not succeed in reading, many years ago.

When temporarily in Washington at the end of the 2002 summer, he chose to make a minor exception to what had been for some years his regular rule and gave brief answers to two questioners in the seriousness of whose discretion he had confidence. A portion of those responses, dealing with the predictable effects of any purely military invasion of Iraq, was printed in the Letters to the Editor column of *The New York Times* some seven months later in their issue of May 16, 2003.

PROFESSOR IRVING LAVIN continues to serve on the editorial boards of a number of scholarly journals, including *Quaderni d'italianistica*, *History of European Ideas*, *Art e Dossier*, and *Palladio, rivista di storia dell' architettura e restauro*. He participated as a member of the Board of Trustees of the SacraTech Foundation at St. Louis University. He gave a course of lectures at the Istituto Italiano per gli Studi Filosofici in Naples, and a number of lectures and papers presented at symposia, including: Accademia Nazionale dei Lincei, Rome; colloquium "Il Ritratto nell'Europa del Cinquecento," Palazzo Strozzi, Florence; Fondazione Giorgio Cini, Venice; Busch Reisinger Museum, Cambridge, Mass.; Academia Española de Historia, Arqueologia y Bella Artes, Rome, Italy. Publications include: "Les filles d'avignon. Picassos schöpferische Summe von Zerstörungen," in Steingrim Laursen and Ostrud Westheider, eds., *Picasso und die Mythen*, exhib. cat., Hamburg, 2002, 42-55.

PROFESSOR PETER PARET published *An Artist Against the Third Reich: Ernst Barlach, 1933-1938* (Cambridge University Press, 2003). He contributed two essays, "Bemerkungen zu einem 'seltsamen Freundespaar'" and "Zehn unbekannte Briefe Barlachs" to *Ernst Barlach im Kunstsalon und Verlag Paul Cassirer*, ed. Volker Probst and Helga Thieme, Güstrow, 2003, the catalogue of the exhibition of Barlach's works on which he collaborated and which opened on June 15, 2003. He also wrote an essay "Crossing Borders," which appeared in *Historically Speaking*, IV, 2 (November 2002), as well as reviews in the *American Historical Review* and in *Central European History*.

Professor Paret has begun work on a new project in German cultural history, and is writing papers on historiography and on the methodology of interdisciplinary studies for delivery at conferences in the fall and winter of 2003 in this country and in Europe.

PROFESSOR MORTON WHITE's book, *A Philosophy of Culture: The Scope of Holistic Pragmatism*, was published in 2003 by Princeton University Press, which has agreed to publish a volume of his essays entitled *Selected Studies in Philosophy and the History of Ideas*. During three weeks in October, 2002, Professor White delivered three invited lectures at Keio University in Tokyo on holistic pragmatism in science, ethics, and epistemology; and in May, 2003, his essay, "Tolstoy the Empirical Fox", appeared in *Raritan: A Quarterly Review*, published at Rutgers University. He continues to work on a study of the decline and fall of classical rationalism from Descartes to the twentieth century, and to serve on the Council of the American Philosophical Society in Philadelphia.

THE SCHOOL OF HISTORICAL STUDIES

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THE SCHOOL OF HISTORICAL STUDIES

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Historical Studies

Academic Year 2002-03

September 30
Historical Studies Lunchtime Colloquium: Introductions

October 2
School Lecture: "Pope Pius XII and the Holocaust"
ROBERT WISTRICH, *Hebrew University, Jerusalem*

October 7
Historical Studies Lunchtime Colloquium: "Democracy Denied, 1905-1915: Intellectuals and the Fate of Constitutional Revolutions"
CHARLES KURZMAN, *University of North Carolina, Chapel Hill; Member, School of Historical Studies*

October 8
East Asian Studies Seminar: "It Returns Our Calls: The Use and Abuse of Memory in a Chinese Community"
QIN SHAO, *The College of New Jersey*

Medieval Seminar: "The Gesta of the Bishops of Auxerre in the Ninth Century"
CONSTANCE BOUCHARD, *University of Akron; Member, School of Historical Studies*

October 14
Historical Studies Lunchtime Colloquium: "Euripides' Chrysippus and the Problematization of Pederasty in Athenian Democratic Discourse"
THOMAS HUBBARD, *University of Texas, Austin; Member, School of Historical Studies*

October 18
Empire Group: "The Early Roman Empire"
EMMA DENCH, *Birkbeck College, University of London; Member, School of Historical Studies*

October 21
Historical Studies Lunchtime Colloquium: "Pages, Proofs, and Caravaggio's Grand Master: The Wignacourt Portrait Re-Examined"
DAVID STONE, *University of Delaware; Member, School of Historical Studies*

October 22
East Asian Studies Seminar: "Japanese Historical Fiction about China: On Translating Shiba Ryōtarō into English"
JOSHUA FOGEL, *University of California, Santa Barbara; Mellon Visiting Professor, School of Historical Studies*

Medieval Seminar: "Corruption in the Twelfth-Century Bokhara"
BABER JOHANSEN, *École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies*

October 28
Empire Group: "The Ottoman Empire"
LESLIE PEIRCE, *University of California, Berkeley; Member, School of Historical Studies*

Historical Studies Lunchtime Colloquium: "Uses of Poetry in Early China"
MARTIN KERN, *Princeton University; Member, School of Historical Studies*

November 4
Empire Group: "A Sociological Approach to the Rise and Fall of Empires"
CHARLES KURZMAN, *University of North Carolina, Chapel Hill; Member, School of Historical Studies*

Historical Studies Lunchtime Colloquium: "What Changes When Words Change: Nervousness in Modern China"
HUGH SHAPIRO, *University of Nevada, Reno; Member, School of Historical Studies*

November 5
The Islamicist Seminar: "The Legal Person: Proprietor or Believer?"
BABER JOHANSEN, *École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies*

East Asian Studies Seminar: "Mapping Peking"
SUSAN NAQUIN, *Princeton University*

November 11
Empire Group: "Safavid Attitudes to Subject Peoples"
RUDOLPH MATTHEE, *University of Delaware; Member, School of Historical Studies*

Historical Studies Lunchtime Colloquium: "Mechanics, Museums, and Exhibitions: The Utility of Collecting"
ROBERT ANDERSON, *British Museum; Member, School of Historical Studies*

November 18
Empire Group: "Indian Empires"
ANDRÉ WINK, *University of Wisconsin, Madison; Member, School of Historical Studies*

Historical Studies Lunchtime Colloquium: "The Sphinx: A Greek Monster's Indian Background"
JOSHUA KATZ, *Princeton University; Member, School of Historical Studies*

November 19
East Asian Studies Seminar: "Matching Names and Actualities: Translation and the Discovery of 'Chinese Logic'"
JOACHIM KURTZ, *University of Erlangen; Member, School of Historical Studies*

November 25
Historical Studies Lunchtime Colloquium: "The Old Testament, History, and the Church (Latin Christian Historians and Exegetes, Patristic and Medieval)"
ELISABETH MÉGIER, *Independent Scholar; Member, School of Historical Studies*

November 26
Medieval Seminar: "Hugh of Fleury and the Spiritual Understanding of the Bible"
ELISABETH MÉGIER, *Independent Scholar; Member, School of Historical Studies*

December 2
Empire Group: "Justifications of Conquest"
PATRICIA CRONE, *Professor, School of Historical Studies*

Historical Studies Lunchtime Colloquium: "Crafts and Craftpersons of Kutch"
MARIAM DOSSAL PANJWANI, *University of Mumbai; Member, School of Historical Studies*

December 3
East Asian Studies Seminar: "How Different are Chinese and Western Medicine? The Case of Neurasthenia"
HUGH SHAPIRO, *University of Nevada, Reno; Member, School of Historical Studies*

Medieval Seminar: "John of Salisbury and the Bible"
JULIE BARRAU, *Independent Scholar*

December 9
School Lecture: "A European (British) View of the Struggle Against Terrorism"
GENERAL LORD GUTHRIE, *Former United Kingdom Chief of Defense*

Empire Group: "Siam"
NEIL ENGLEHART, *Lafayette College; Member, School of Social Science*

Historical Studies Lunchtime Colloquium: "Between Impressionism and Cubism: Carl Einstein's *Bebuquin, or Dilettantes of the Miracle*"
CHARLES (MARK) HAXTHAUSEN, *Williams College; Member, School of Historical Studies*

December 11
The Islamicist Seminar: "Who and What Were the Orang Laut?"
ANDRÉ WINK, *University of Wisconsin, Madison; Member, School of Historical Studies*

December 16
Historical Studies Lunchtime Colloquium: "The Zodiac in Ancient Jewish Art: The Dual Meaning of a Symbol"
ZEEV WEISS, *The Hebrew University of Jerusalem; Member, School of Historical Studies*

December 17
Medieval Seminar: "Broadening the Narrative in Early Medieval History: Incorporating the Evidence of Paleoarchaeology in Anglo-Saxon History"
ROBIN FLEMING, *Boston College; Member, School of Historical Studies*

January 13
Historical Studies Lunchtime Colloquium: Introductions

January 14
East Asian Studies Seminar: "The Geopolitics of 'Sacred Ground' in Postwar Okinawa"
GERALD FIGAL, *University of Delaware*

January

Historical Studies Lunchtime Colloquium:
"*Deutsche Frage* and Reformation:
A New Approach"
WILLIAM CONNELL, *Seton Hall University; Member, School of Historical Studies*

January 27

Empire Group: "Chinese Concepts of Imperial Government"
BENJAMIN ELMAN, *Princeton University*

Historical Studies Lunchtime Colloquium:
"Beauty and Truth"
BENJAMIN BINSTOCK, *New York University; Member, School of Historical Studies*

January 28

East Asian Studies Seminar: "Who Buried Qiu Jin?"
HU YING, *University of California, Irvine; Member, School of Historical Studies*

February 3

Historical Studies Lunchtime Colloquium:
"Wine in Early Modern Iran: Ritual, Pleasure, and Proscription"
RUDOLPH MATTHEE, *University of Delaware; Member, School of Historical Studies*

February 7 - 8

East Asian Studies Workshop: "Is it Really Like Kissing Through a Handkerchief? Reading and Translation from Chinese and Japanese"
"On the Tasks of the Translator"
JOSHUA FOGEL, *University of California, Santa Barbara; Mellon Visiting Professor, School of Historical Studies*

Translating from Premodern Chinese and Japanese:
"Rose or Jade? Problems of Translating Medieval Chinese Literature"
DAVID KNECHTGES, *University of Washington*
"The Good, the Bad and the Ugly: Expletives, Misprision, and Pidgin in Zeami's Performance Notes"
THOMAS HARE, *Princeton University*

Translating from Modern and Contemporary Chinese:
"The Early Translations of Western Fiction into Chinese"
PATRICK HANAN, *Harvard University*
"Why and How Non-Existent Mirrors Are Useful: My View of Translation"
PERRY LINK, *Princeton University*

Translating Contemporary Japanese Fiction:
"Conveying the Author's Voice: Translating Style"
JOHN NATHAN, *University of California, Santa Barbara*
"No Smoking: What to Do When the Author Gets it Wrong"
JAY RUBIN, *Harvard University*

Lingering Theoretical Problems:
"Translating; or, What Do You Do with the Remainder?"
LAWRENCE VENUTI, *Temple University*

February 10

Historical Studies Lunchtime Colloquium:
"Mutations of the Year 800: Was Charlemagne Really a Glorious Turning Point?"
CONSTANCE BOUCHARD, *University of Akron; Member, School of Historical Studies*

February 14

Empire Group: "Empires and Mercenaries"
NINO LURAGHI, *Harvard University; Member, School of Historical Studies*

February 18

Medieval Seminar: "Women and the Liturgy in the Late Medieval English Parish"
KATHERINE FRENCH, *State University of New York, New Paltz; Visitor, School of Historical Studies*

February 24

Historical Studies Lunchtime Colloquium:
"Traders, Pirates, Warriors: Greeks in the Levant in the Early Iron Age"
NINO LURAGHI, *Harvard University; Member, School of Historical Studies*

March 3

Historical Studies Lunchtime Colloquium:
"How to Bury A Revolutionary: Biography, Epigraphy, Calligraphy"
HU YING, *University of California, Irvine; Member, School of Historical Studies*

March 4

Medieval Seminar: "Sorting Out the Family: Power, Kinship, and Conflict in Early Catalonia"
STEPHEN BENSCH, *Swarthmore College; Member, School of Historical Studies*

March 5

School Lecture: "American Foreign Policy in an Age of Preeminence"
STROBE TALBOTT, *Brookings Institution*

March 10
Historical Studies Lunchtime Colloquium:
"Family and Constitution in Modern Egyptian Law"
BABER JOHANSEN, *École des Hautes Études en Sciences Sociales, Paris; Member, School of Historical Studies*

March 11
East Asian Studies Seminar: "Early Chinese Aesthetics of Poetry and Persuasion"
MARTIN KERN, *Princeton University; Member, School of Historical Studies*

Medieval Seminar: "Manuscript Painting in Paris and Rouen During the English Occupation (1419-1449)"
GREGORY CLARK, *University of the South; Member, School of Historical Studies*

March 17
Historical Studies Lunchtime Colloquium:
"Venetians, English, and Greeks:
A Reassessment of Eastern Mediterranean Trade in the Early Modern Period"
MARIA FUSARO, *University of Chicago; Member, School of Historical Studies*

March 18
Medieval Seminar: "Castiglione, Signor Gasparo, and the Lombard Nobility"
WILLIAM CONNELL, *Seton Hall University; Member, School of Historical Studies*

March 24
Historical Studies Lunchtime Colloquium:
"Adémar de Chabannes (989-1034), Monastic Musician Extraordinaire"
JAMES GRIER, *University of Western Ontario; Member, School of Historical Studies*

March 25
East Asian Studies Seminar: "Cosmology, Civilization, and the Meanings of Female Virtue in Late Qing China"
JOAN JUDGE, *University of California, Santa Barbara; Visitor, School of Historical Studies*

March 26
The Islamicist Seminar: "Ottoman Clothing Regulations"
MADELINE ZILFI, *University of Maryland*

March 31
Historical Studies Lunchtime Colloquium:
"Polyglotism and (the Ottoman) Empire:
Writing Bigger History"
LESLIE PEIRCE, *University of California, Berkeley; Member, School of Historical Studies*

April 1
East Asian Studies Seminar: "Nalan Xingde's (1655-1685) Appreciation of Chinese Calligraphy and Pictorial Art"
ERLING VON MENDE, *Free University of Berlin*

April 2
The Islamicist Seminar: "Ottoman *Kalam*"
M. SAIT ÖZERVARLI, *Center for Islamic Studies, Istanbul; Member, School of Historical Studies*

April 14
Empire Group: "Attitudes to the Greeks in Hellenistic Egypt"
GETZEL COHEN, *University of Cincinnati; Visitor, School of Historical Studies*

April 21
Empire Group: "The Achaemenids"
SUSANNA EBBINGHAUS, *Research Fellow, Gerda Henkel Stiftung*

April 28
Empire Group: "The Ottonians"
STEPHEN BENSCH, *Swarthmore College; Member, School of Historical Studies*

May 1
School Lecture: "Early Years at the School of Historical Studies"
GEORGE DYSON, *Director's Visitor*

May 21
Empire Group: "Imperial Government in Antiquity"
MICHAEL MAAS, *Rice University; former Member, School of Historical Studies*

In addition to the events listed above, some groups also met informally. This included weekly gatherings over lunch for Members and Visitors in art history and classics, who met to discuss ongoing projects and the specific problems encountered in their research. Individual Faculty members also occasionally arranged other informal gatherings or talks by invited speakers. Although these do not appear on the above list, these informal gatherings also played an important role in the intellectual life of the School.

"The Institute provides unrivaled conditions for conducting research. The focus on research and the quietness allow you to start long-term programs and learning cycles."

—Member, School of Mathematics

Robert Langlands, Professor in the School of Mathematics, in his office in Fuld Hall

THE SCHOOL OF MATHEMATICS

Faculty

ENRICO BOMBIERI, *IBM von Neumann Professor*
JEAN BOURGAIN
PIERRE DELIGNE
ROBERT P. LANGLANDS, *Hermann Weyl Professor*
ROBERT D. MacPHERSON
THOMAS SPENCER
VLADIMIR VOEVODSKY
AVI WIGDERSON

Professors Emeriti

ARMAND BOREL
ATLE SELBERG

ACADEMIC ACTIVITIES

This year's special program in the School of Mathematics concentrated on applied mathematics and was entitled "Stochastic Partial Differential Equations and Models of Turbulence". Weinan E (Princeton University) and Gregory Falkovich (Weizmann Institute of Science), were the main organizers together with the School of Mathematics. Other senior participants included John Ball (Oxford), Krzysztof Gawedzki (Lyon), Massimo Vergassola (Nice), and Horng-Tzer Yau (NYU). Approximately 20 of the School's members actively participated in this program.

The aim of this program was to bring together researchers from mathematics, physics, and fluid mechanics to explore mathematical aspects of fluid flow, especially those motivated by turbulence. Although the problem of three-dimensional turbulence has been extensively studied over the past century, our mathematical understanding of important issues such as regularity, intermittency, and coherent structures is still primitive. For this reason there has been a surge of activity and progress on a more tractable class of differential equations with random coefficients which are expected to share some of the same features observed in three-dimensional turbulence. Such models include advection by a passive scalar and the randomly driven Burgers equation. This year's program built upon this progress and extended it to include new directions of research.

The major topics covered in this year's program were broader than initially anticipated and included the following:

1) Advection of passive scalar
2) Wave turbulence
3) Stochastically driven Burgers equation
4) The structure of invariant measures for Navier Stokes and related PDE
5) Theory and numerics of transition pathways in rough landscapes
6) Modeling neural activity of the visual cortex
7) Description of inertial particles in incompressible flows.

There were approximately two-to-three seminars per week in which the senior participants gave expository lectures about their work and junior Members elaborated on the ideas which they presented informally at the start of the term. In addition, there were several minicourses on various aspects of non-equilibrium statistical mechanics covering topics such as "weak turbulence" and "energy landscapes and rare events". Other informal meetings addressed uniqueness and regularity of invariant measures which provide a statistical description of chaotic flows.

There were three conferences during this program. The first concerned "Stochastic and multi-scale problems in the Sciences". The purpose of this conference was to bring together leading scientists from several disciplines including biology, chemistry, complex fluids, material sciences, and mathematics to exchange ideas and to identify common themes and new frontiers of further research. The second conference entitled "Conference on Stochastic Differential Equations" was more mathematical in character and was devoted to the analysis of qualitative properties of solutions of stochastic partial differential equations that arise in applications. The last conference focused on models of turbulence and brought together both theorists and experimentalists to discuss the present state of the field and to offer unifying approaches to the analysis of non-equilibrium systems. Topics included general turbulence theory, singularity formation in fluids, mixing, and the distribution of inertial particles (such as water vapor) in turbulent flows. Finally, there was a one-day workshop devoted to examining the role of noise in neural networks.

Highlights of the research in special programs:

D. Cai made significant progress modeling the neural activity of the visual cortex. In the recent work, he and his collaborators have been able to go beyond the usual models of mean dynamics and include fluctuations which are crucial for an understanding of many phenomena.

H.-T. Yau proved new results about logarithmic fluctuations of the bulk diffusion for a class of two-dimensional interacting particle systems. These results imply the lack of a classical hydrodynamic scaling. In another paper, he has also established significantly longer time scales for the transport of a quantum particle in a weak random potential.

Another area of activity at the Institute concerned the behavior of inertial finite size particles in an incompressible random flow. This has been a very active field of activity at the Institute this year and was studied from both a theoretical and applied perspective. Of particular physical interest are mechanisms for accelerated formation of rain in warm clouds. A key ingredient of this work is understanding the clustering of inertial particles on multifractal dynamical sets and incorporating this structure into certain kinetic equations. This work was carried out by J. Bec, G. Falkovich, K. Gawedzki, M. Stepanov, and others.

Weinan E, W. Ren, and E. Vanden Eijnden have developed the theoretical foundation and numerical methods for studying the transition between metastable configurations with rough energy landscapes. In this situation, the conventional Wentzel-Freidlin theory is not practical. The new framework extends standard potential theory by exploiting the spectral gap between small eigenvalues associated with the metastable states and the larger eigenvalues associated with relaxation processes. This approach has been successfully applied to numerous problems in material sciences and chemistry and is now being used to study transition pathways in protein dynamics.

Seminars

There was a weekly seminar in classical statistical mechanics. David Sherrington (Oxford) was here for the fall term and John Cardy (Oxford) and Stanislav Smirnov (KTH Stockholm) were here during the spring term. Both Cardy and Sherrington had joint appointments in the School of Natural Sciences. Sherrington spoke about "Statistical physics of non-equilibrium disordered and frustrated many body problems". Cardy and Smirnov gave expository talks about remarkable progress on scaling limits of two-dimensional statistical mechanics models at the critical temperature.

During the fall term, a seminar entitled "Arnold diffusion" was organized by Dmitry Dolgopyat and Vadim Kaloshin. This seminar concerned the long-time behavior of chaotic motions from both a deterministic and probabilistic perspective. It provided an interesting complement to the themes of the special program. The organizers gave talks about variational geometric approaches to Arnold diffusion, and Jean Bourgain gave an infinite dimensional version of this diffusion. During the second term, Percy Deift (NYU) and Emma Previato (Boston University) organized a seminar on "Aspects of integrability" which covered such diverse topics as the spectral theory of random matrices, and Gromov-Witten theory and solutions in algebraic geometry.

The Number Theory Seminar was organized jointly with Princeton University and Rutgers University. Among the highlights of this seminar were talks by P. Sarnak (Princeton) on "Classical versus quantum fluctuations for the modular surface" and by H. Iwaniec (Rutgers) on "Exceptional zero and prime numbers".

The program in theoretical computer science and discrete mathematics engaged in intensive research covering almost all areas of theoretical computer science as well as many directions in combinatorics. Some particular topics include de-Randomization, proof complexity, quantum computing, and communication complexity. Altogether the program included four senior Members (Arora, Raz, Razborov, Rockmore) and eight postdoctoral Members. Some 25 people came to visit for a short time ranging from a few days to one month. The main educational component of the program consisted of two weekly seminars. One of them was quite traditional (guest speakers, one hour talks), whereas the second was much more informal and specifically designed as a venue for the program's residents to present more detailed expositions of their research.

The Marston Morse Memorial Lectures entitled "Motivic Algebraic Geometry" were delivered by Fabien Morel (Université de Paris, Jussieu). This was a series of three expository lectures on the homotopy theory for algebraic varieties with applications to the proof of the Milnor Conjecture.

In August 2002, Vladimir Voevodsky received one of two Fields Medals awarded in Beijing, China for his work in developing new cohomology theories for algebraic varieties thereby providing new insights into number theory and algebraic geometry.

Enrico Bombieri was elected a Fellow of the European Academy of Sciences.

Next year's special program "Analysis and non-linear PDE's" will be led by Carlos Kenig (U. Chicago) and Jean Bourgain. Topics include dispersive Hamiltonian systems, equations with critical nonlinearity, and the structure of singularity formation. The following year, Vladimir Voevodsky will lead a program on the Bloch-Kato conjecture relating Milnor's K-theory and etale cohomology.

MEMBERS AND VISITORS

SANJEEV ARORA
Complexity Theory, Approximation
Princeton University · *v*

YURI BAKHTIN
Mathematical, Statistical Hydrodynamics
International Institute of Earthquake Prediction Theory, Russia

ALEXANDER BALK
Wave Turbulence, Nonlinear Phenomena
University of Utah

JOHN BALL
Calculus of Variations, Materials Science, Nonlinear PDEs
University of Oxford

JÉRÉMIE BEC
Turbulence
Observatoire de Nice, France · *s*

JOEL BELLAICHE
Automorphic Forms
École Normale Supérieure Paris, France · *f*

SIMON BRENDLE
Applied Mathematics, Probability
Universität Tubingen, Germany · *i*

JARED BRONSKI
Applied Math, Nonlinear Waves
University of Illinois, Urbana-Champaign · *s*

SHENOU CAI
Nonlinear Dispersive Waves
Courant Institute, New York University

JOHN CARDY
Statistical Mechanics, Non-equilibrium Systems
All Souls College, University of Oxford · *j, s*

ANA-MARIA CASTRAVET
Algebraic Geometry
Massachusetts Institute of Technology

AMIT CHAKRABARTI
Complexity Theory and Approximation Algorithms
Princeton University

ADRIAN CLINGHER
String Dualities
Columbia University · *j*

PERCY DEIFT
Integrable Systems and Spectral Theory
Courant Institute, New York University · *s*

LUCIA DI VIZIO
Differential and Q-difference Equations
Centre National de la Recherche Scientifique, France

JONATHAN DIMOCK
Constructive Quantum Field Theory
State University of New York, Buffalo · *f*

ZINDINE DJADLI
Geometric Analysis
Université de Cergy-Pontoise, France · *v*

DMITRY DOLGOPYAT
Statistical Properties of Dynamical Systems
Pennsylvania State University

WEINAN E
Fluid Equations, Imcompressible Flows
Princeton University

MICHAEL ELKIN
Algorithmics, Graph Theory
Weizmann Institute of Science, Israel

GREGORY FALKOVICH
Turbulence Theory
Weizmann Institute of Science, Israel

IBRAHIM FATKULLIN
Stochastic Forcing
Courant Institute, New York University

KRZYSZTOF GAWEDZKI
Mathematical Physics
École Normale Supérieure de Lyon, France · *s*

* On leave academic year
dvp Distinguished Visiting Professor · *f* First Term · *i* Veblen Research Instructorship · *s* Second Term · *v* Visitor

MARK GORESKY
Geometry, Automorphic Forms
Institute for Advanced Study

NADYA GUREVICH
Automorphic Forms
Institute for Advanced Study · *i*

VILLE HAKULINEN
Passive Advection
Institut Mittag-Leffler, Sweden

FENGBO HANG
Geometric Analysis, Partial Differential Equations
Institute for Advanced Study · *i*

PHILLIP HOLMES
Applied Dynamical Systems
Princeton University · *s*

VADIM KALOSHIN
Dynamical Systems
Massachusetts Institute of Technology

TAKASHI KIMURA
Intersection Theory
Boston University

HARTMUT KLAUCK
Quantum Computing
Centrum voor Wiskunde en Informatica,
The Netherlands

MUTHUKRISHNAN KRISHNAMURTHY
Automorphic Forms
Purdue University, West Lafayette

LING LONG
Number Theory, Algebraic Geometry
Pennsylvania State University

JOHN LUECKE
Low-dimensional Topology
University of Texas, Austin

ANDREA MALCHIODI
Nonlinear Analysis
Institute for Advanced Study

JONATHAN MATTINGLY
Stochastic PDEs
Stanford University

KEVIN McGERTY
Geometric Representation Theory
Massachusetts Institute of Technology

PAUL MELVIN
Low-dimensional Topology, Quantum Topology
Bryn Mawr College · *v, f · s*

TAKURO MOCHIZUKI
Algebraic Geometry
Institute for Advanced Study

HEE OH
Discrete Subgroups
Princeton University

LUKE PEBODY
Combinatorics, Graph Theory
University of Memphis

JULIA PEVTSOVA
Modular Representation Theory
Northwestern University

JONATHAN PILA
Number Theory
University of Melbourne, Australia

EMMA PREVIATO
Moduli Spaces, Differential Equations
Boston University

GEORGES RACINET
Multiple Zeta Values, Multiple Polylogarithms
Institut für Mathematik, Germany · *f*

RAN RAZ
Complexity Theory
Weizmann Institute of Science, Israel · *f*

ALEXANDER RAZBOROV
Theoretical Computer Science
Institute for Advanced Study

ODED REGEV
Approximation Methods, Scheduling
Institute for Advanced Study

OMER REINGOLD
Cryptography, Computational Complexity
Institute for Advanced Study · *v*

* On leave academic year
dtp Distinguished Visiting Professor · *f* First Term · *i* Veblen Research Instructorship · *s* Second Term · *v* Visitor

WEIQING REN
Scientific Computation
Courant Institute, New York University

DANIEL ROCKMORE
Fast Fourier Transforms
Dartmouth College · *f*

IGOR RODNIANSKI
Schrodinger Evolution, Geometric Analysis
Princeton University · *f*

DAVID SHERRINGTON
Many Body Systems
University of Oxford · *j, f*

NADYA SHIROKOVA
Differential Geometry, Topology
University of Illinois, Urbana-Champaign

ADAM SIKORA
Low-dimensional Topology
Centre de Recherches Mathématiques, Canada · *s*

STANISLAV SMIRNOV
Complex and Harmonic Analysis
Royal Institute of Technology, Sweden · *s*

ERIC SOMMERS
Representation Theory
Harvard University

MIKHAIL STEPANOV
Probability
Institute of Automation and Electrometry, Russia

BENJAMIN SUDAKOV
Combinatorics
Princeton University · *s*

TOUFIC SUIDAN
Probability Theory
Courant Institute, New York University

XIAODONG SUN
Computer Science
Rutgers University, Piscataway

TOMOHIDE TERASOMA
Hodge Theory
University of Tokyo, Japan

YEN-HSI TSAI
Numerical Analysis
University of California, Los Angeles · *t*

ERIC VANDEN EIJNDEN
Applied Mathematics
Courant Institute, New York University · *v, f · s*

MASSIMO VERGASSOLA
Statistical Physics
Observatoire de la Côte d'Azur, France · *s*

WEI-MIN WANG
Analysis and Mathematical Physics
Centre National de la Recherche Scientifique

XIAOMING WANG
PDEs
Courant Institute, New York University · *f*

ANDREW WILES
Algebraic Number Theory
Princeton University and Institute for Advanced Study · *s*

HUI XUE
Special Values of L-series
Columbia University

HORNG-TZER YAU
Mathematical Physics
Courant Institute, New York University · *s*

* On leave academic year
dp Distinguished Visiting Professor · *f* First Term · *t* Veblen Research Instructorship · *s* Second Term · *v* Visitor

THE SCHOOL OF MATHEMATICS

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Mathematics

Academic Year 2002-03

September 9

Computer Science/Discrete Math Seminar I:
"Derandomizing Polynomial Identity Tests Means Proving Circuit Lower Bounds"
VALENTINE KABANETS, *University of California, San Diego*

Computer Science/Discrete Math Seminar II:
"A Switching Lemma for Small Restrictions and Lower Bounds for k-DNF Resolution"
RUSSELL IMPAGLIAZZO, *University of California, San Diego*

September 17

Computer Science/Discrete Math Seminar II:
"Mixing in Time and Space on the Integer Lattice: A Combinatorial View"
DROR WEITZ, *University of California, Berkeley*

September 23

Computer Science/Discrete Math Seminar I:
"Phase Transitions for Random Processes"
JOEL SPENCER, *Courant Institute of Mathematical Sciences, New York University*

Computer Science/Discrete Math Seminar II:
"Topological Lower Bounds for the Chromatic Number: A Hierarchy"
JIRI MATOUSEK, *Charles University, Prague*

September 24

Computer Science/Discrete Math Seminar III:
"Proving Integrality Gaps without Knowing the Linear Program"
SANJEEV ARORA, *Princeton University; Visitor, School of Mathematics*

September 26

Special Seminar: "On the Cohomology of Arithmetic Manifolds: Vanishing and Nonvanishing Results"
JOACHIM SCHWERMER, *University of Vienna*

September 27

Short Talks by Postdoctoral Members: "Modular Forms and Representation Theory"
JOEL BELLAICHE, *École Normale Supérieure, Paris; Member, School of Mathematics;* NADYA GUREVICH, *Member, School of Mathematics;* MATHUKRISHNAN KRISHNAMURTHY, *Purdue University, West Lafayette; Member, School of Mathematics;* HEE OH, *Princeton University; Member, School of Mathematics;* and HUI XUE, *Columbia University; Member, School of Mathematics*

September 30

Computer Science/Discrete Math Seminar I:
"Dimension Reduction in the l_1 Norm"
MOSES CHARIKAR, *Princeton University*

Short Talks by Postdoctoral Members: "Algebraic Geometry and Geometric Representation Theory"
ANA-MARIA CASTRAVET, *Massachusetts Institute of Technology; Member, School of Mathematics;* LING LONG, *Pennsylvania State University; Member, School of Mathematics;* KEVIN McGERTY, *Massachusetts Institute of Technology; Member, School of Mathematics;* TAKURO MOCHIZUKI, *Member, School of Mathematics;* JULIA PEVTSOVA, *Northwestern University; Member, School of Mathematics;* and ERIC SOMMERS, *Harvard University; Member, School of Mathematics*

October 1

Computer Science/Discrete Math Seminar II:
"Quantum Security in the Bounded Storage Model"
HARTMUT KLAUCK, *Centrum voor Wiskunde en Informatica, The Netherlands; Member, School of Mathematics*

Short Talks by Postdoctoral Members: Algebra and Geometry

October 3

Short Talks by Junior Members: Analysis
"Asymptotic Limits of Perturbed Ginzburg-Landau Systems"
IBRAHIM FATKULLIN, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*
"Degenerate Elliptic Operators in Passive Advection"
VILLE HAKULINEN, *Institut Mittag-Leffler, Sweden; Member, School of Mathematics*
"Approximation of Sobolev Mappings"
FENGBO HANG, *Member, School of Mathematics*
"Prevalence of Certain Phenomena in Dynamical Systems"
VADIM KALOSHIN, *Massachusetts Institute of Technology; Member, School of Mathematics*
"On Multi-Dimensional Spike Layers"
ANDREA MALCHIODI, *Member, School of Mathematics*
"Randomly Forced Burgers Equation"
TOUFIC SUIDAN, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

October 4

Short Talks by Junior Members: Computer Science and Discrete Mathematics
"The Hardness of Testing Graph Properties"
AMIT CHAKRABARTI, *Princeton University; Member, School of Mathematics*
"Approximating Graph Metrics by Sparse Subgraphs"
MICHAEL ELKIN, *Weizmann Institute of Science, Israel; Member, School of Mathematics*
"Quantum Communication Complexity"
HARTMUT KLAUCK, *Centrum voor Wiskunde en Informatica, The Netherlands; Member, School of Mathematics*
"Reconstruction of Finite Groups"
LUKE PEBODY, *University of Memphis; Member, School of Mathematics*
"Tradeoff Lower Bounds"
XIAODONG SUN, *Rutgers University, Piscataway; Member, School of Mathematics*

Short Talks by Junior Members: Analysis
"Tunable Dynamics and Bistability of Neural Networks"
DAVID CAI, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*
"Hyperbolicity and Chaos"
DIMTRY DOLGOPYAT, *Pennsylvania State University; Member, School of Mathematics*
"Stochastic Navier Stokes"
JONATHAN MATTINGLY, *Stanford University; Member, School of Mathematics*
"Numerical Methods for the Study of Rare Events"
WEIQING REN, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*
"Topic in Analysis"
IGOR RODNIANSKI, *Princeton University; Member, School of Mathematics*
"Some Aspects of Stochastic Modeling in Complex Systems"
ERIC VANDEN-EIJNDEN, *Courant Institute of Mathematical Sciences, New York University; Visitor and Member, School of Mathematics*

October 7

Computer Science/Discrete Math Seminar I:
"The Elusiveness of Braess's Paradox: Designing Networks for Selfish Users is Hard"
TIM ROUGHGARDEN, *Cornell University*

October 8

Computer Science/Discrete Math Seminar II:
"Universally Composable Security: Overview of the Paradigm and Some Constructions"
RAN CANETTI, *IBM Watson Research Center*

October 9

Geometric Representation Theory Seminar:
"The Peterson Variety and Total Positivity"
KONSTANZE RIETSCH, *King's College, London*

October 10

Dynamical Systems Seminar: "Lyapunov Exponents in Non-Perturbative Regime"
RAPHAEL KRIKORIAN, *École Polytechnique*

Princeton/IAS/Rutgers Number Theory Seminar:
"Congruences Involving Non-Tempered Automorphic Forms and Bloch-Kato Conjectures"
JOËL BELLAÍCHE, *École Normale Supérieure, Paris; Member, School of Mathematics*

October 11

Statistical Mechanics Seminar: "Statistical Physics of Fiber Optics Communications"
MICHAEL CHERTKOV, *Los Alamos National Laboratory*

Stochastic Analysis and Modeling Seminar:
"Statistical Integrals of Motion and Anomalous Scaling in Turbulence"
GREGORY FALKOVICH, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

Stochastic Analysis and Modeling Seminar:
"Generalized Flow and Turbulent Transport"
ERIC VANDEN-EIJNDEN, *Courant Institute of Mathematical Sciences, New York University; Visitor and Member, School of Mathematics*

Stochastic Analysis and Modeling Seminar:
"Degenerate Elliptic Operators in Passive Advection"
VILLE HAKULINEN, *Institut Mittag-Leffler, Sweden; Member, School of Mathematics*

October 14

Computer Science/Discrete Math Seminar I:
"The Hardness of 3-Uniform Hypergraph Coloring"
IRIT DINUR, *NEC Research*

October 15

Computer Science/Discrete Math Seminar II:
"Time-Space Tradeoff Lower Bounds for Randomized Computation"
XIAODONG SUN, *Rutgers University, Piscataway; Member, School of Mathematics*

October 18

Applied Math/Statistical Mechanics Seminar:
"Reduced Dynamics for Stochastically Perturbed Models"
IBRAHIM FATKULLIN, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

October 21

Computer Science/Discrete Math Seminar I:
"Free and Pseudo-Surjective Functions, and Provability of Circuit Lower Bounds"
JAN KRAJICEK, *Czech Academy of Sciences, Prague*

Members Seminar: "Some Problems on Entire Arithmetic Functions"
JONATHAN PILA, *University of Melbourne; Member, School of Mathematics*

October 22

Computer Science/Discrete Math Seminar II:
"Time-Space Tradeoff Lower Bounds for Randomized Computation (Continued)"
XIAODONG SUN, *Rutgers University, Piscataway; Member, School of Mathematics*

October 24

Geometric Representation Theory Seminar:
"The Singular Locus of a Schubert Variety"
CHRISTIAN KASSEL, *CNRS et Université Louis Pasteur, Strasbourg*

October 25

Applied Math/Statistical Mechanics Seminar:
"Modeling and Computation of Tumor Growth"
QING NIE, *University of California, Irvine*

Arnold Diffusion Seminar: "Non-Genericity of Minimizing Periodic Orbits"
DANIEL MASSART, *Centro de Investigacion en Matematicas, Mexico*

Stochastic Analysis and Modeling Seminar:
"Weak Turbulence"
ALEXANDER BALK, *University of Utah, Member, School of Mathematics*; DAVID CAI, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*; GREGORY FALKOVICH, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

October 28

Computer Science/Discrete Math Seminar I:
"Random Sub-Problems of a Given Problem"
RAVINDRAN KANNAN, *Yale University*

October 29

Analysis/Math Physics Seminar: "A Survey of Quasi-Periodic Localization"
JEAN BOURGAIN, *Professor, School of Mathematics*

Computer Science/Discrete Math Seminar II:
"Derandomizing Special Polynomial Identities via Cyclotomic Rings"
MANINDRA AGARWAL, *Indian Institute of Technology, India*

November 1

Arnold Diffusion Seminar: "Convergence of Viscosity Solutions for Random Hamilton-Jacobi Equations"
RENATO ITURRIAGA, *Centro de Investigacion en Matematicas, Mexico*

Stochastic Analysis and Modeling Seminar:
"Energy Landscapes and Rare Events"
PHILLIP GEISSLER, *Massachusetts Institute of Technology*; WEIQING REN, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*; and ERIC VANDEN-EIJNDEN, *Courant Institute of Mathematical Sciences, New York University; Visitor and Member, School of Mathematics*

November 4
Computer Science/Discrete Math Seminar I:
"Non-Linear Versions of Dvoretzky's Theorem"
ASSAF NAOR, *Microsoft Research*
Members Seminar: "The Euler-Lagrange Equation and Minimizers in Elastostatics"
JOHN BALL, *University of Oxford; Member, School of Mathematics*

Special Seminar: "The Concept of EPR States and Their Structure"
RAJA VARADARAJAN, *New York University* and *University of California, Los Angeles*

November 5
Analysis/Math Physics Seminar: "The Ultraviolet Problem for $(QED)_3$"
JONATHAN DIMOCK, *State University of New York, Buffalo; Member, School of Mathematics*

Computer Science/Discrete Math Seminar II:
"A Lower Bound for Approximate Nearest Neighbor Searching"
AMIT CHAKRABARTI, *Princeton University; Member, School of Mathematics*

November 7
Arnold Diffusion Seminar: "Variational Approach to Mather Connecting Theorem and Arnold's Example of Diffusion"
VADIM KALOSHIN, *Massachusetts Institute of Technology; Member, School of Mathematics*

Special Seminar: "Computation of Crystal Microstructure"
ZHIPING LI, *Peking University*

November 8
Applied Math/Statistical Physics Seminar: "Various Fluid Equations and Numerical Tests of Their Equivalence to Navier Stokes"
GIOVANNI GALLAVOTTI, *Università degli Studi di Roma, La Sapienza* and *Rutgers University*

Stochastic Analysis and Modeling Seminar:
"Stochastic Navier-Stokes Equations"
JONATHAN MATTINGLY, *Stanford University; Member, School of Mathematics*; LAI-SANG YOUNG, *Courant Institute of Mathematical Sciences, New York University*; XIAOMING M. WANG, *Iowa State University; Member, School of Mathematics*

November 11
Computer Science/Discrete Math Seminar I:
"How Intractable is the 'Invisible Hand': Polynomial Time Algorithms for Market Equilibria"
VIJAY VAZIRANI, *Georgia Tech*

November 12
Analysis/Math Physics Seminar: "MHD Turbulence"
PETER GOLDREICH, *California Institute of Technology; Visiting Professor, School of Natural Sciences*

Computer Science/Discrete Math Seminar II:
"A Lower Bound for Approximate Nearest Neighbor Searching"
AMIT CHAKRABARTI, *Princeton University; Member, School of Mathematics*

November 14
Arnold Diffusion Seminar: "Variational Approach to Mather Connecting Theorem and Arnold's Example of Diffusion (Continued)"
VADIM KALOSHIN, *Massachusetts Institute of Technology; Member, School of Mathematics*

November 15
Applied Math/Statistical Physics Seminar: "Statistics of Fourier Amplitudes in the Kazantsev-Kraichnan Dynamo Model"
SERGEY NAZARENKO, *The University of Warwick*

November 18
Members Seminar: "K3 Surfaces vs. Principal G-bundles on Elliptic Curves, A Comparison of the Moduli Spaces"
ADRIAN CLINGHER, *Columbia University; Member, Schools of Mathematics and Natural Sciences*

November 19
Analysis/Math Physics Seminar: "The Phase Transition in the Biased Integer Partitioning Problem"
JENNIFER CHAYES, *Microsoft Research*

November 21
Arnold Diffusion Seminar: "Tangent Bundle Dynamics"
ENRIQUE PUJALS, *Instituto Nacional de Matemática Pura e Aplicada, Brazil*

November 22
Members Seminar: "Asymptotic Stability of N-Solitons of NLS"
IGOR RODNIANSKI, *Princeton University; Member, School of Mathematics*

November 25
Computer Science/Discrete Math Seminar I:
"Erdos-Renyi Scaling for the n-Cube and Beyond"
CHRISTIAN BORGS, *Microsoft Research*

Computer Science/Discrete Math Seminar II:
"Graphs with Tiny Vector Chromatic Numbers and Huge Chromatic Numbers"
MICHAEL LANGBERG, *Weizmann Institute of Science, Israel*

November 26
Analysis/Math Physics Seminar: "Statistical Physics of Non-Equilibrium Disordered and Frustrated Many Body Systems"
DAVID SHERRINGTON, *University of Oxford; Member, School of Mathematics*

Computer Science/Discrete Math Seminar III:
"Combinatorial Reconstruction Using Invariant Polynomials"
LUKE PEBODY, *University of Memphis; Member, School of Mathematics*

December 2
Members Seminar: "Support Varieties for Finite Group Schemes"
JULIA PEVTSOVA, *Northwestern University; Member, School of Mathematics*

December 3
Computer Science/Discrete Math Seminar I:
"Combinatorial Reconstruction Using Invariant Polynomials (Continued)"
LUKE PEBODY, *University of Memphis; Member, School of Mathematics*

December 5
Arnold Diffusion Seminar: "Geometry of High Frequency Vibrations"
MARK LEVI, *Penn State University*

December 6
Arnold Diffusion Seminar: "Nekhoroshev Estimates for Stability of Nearly Integrable Hamiltonian Systems" (An Elementary Introduction)
DMITRY DOLGOPYAT, *Pennsylvania State University; Member, School of Mathematics*

Arnold Diffusion Seminar: "A Lagrangian Proof of Moser's Twist Theorem"
MARK LEVI, *Penn State University*

Math Seminar: "Generalized Polynomial Chaos for Stochastic PDEs"
DONGBIN XIU, *Brown University*

December 9
Conference on Stochastic and Multi-scale Problems in the Sciences

Computer Science/Discrete Math Seminar I:
"Forbidden Information"
LEONID A. LEVIN, *Boston University*

December 10
Conference on Stochastic and Multi-scale Problems in the Sciences

Computer Science/Discrete Math Seminar II:
"Inapproximability and Instance Complexity of the Distributed Minimum Spanning Tree Problem"
MICHAEL ELKIN, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

December 11
Conference on Stochastic and Multi-scale Problems in the Sciences

December 12
Arnold Diffusion Seminar: "Diffusion in PDE"
JEAN BOURGAIN, *Professor, School of Mathematics*

December 13
Arnold Diffusion Seminar: "Critical Saddle-Node Bifurcations and Morse-Smale Maps"
BRIAN HUNT, *University of Maryland, College Park*

December 16
Computer Science/Discrete Math Seminar I:
"Derandomizing Low Degree Tests via Epsilon-Biased Spaces"
ELI BEN-SASSON, *Harvard University*

Members Seminar: "SL(2,p): Computations, Quantum Chaos, and Conjectures"
DANIEL ROCKMORE, *Dartmouth College; Member, School of Mathematics*

December 17
Computer Science/Discrete Math Seminar II:
"Path Algebras for FFTs on Groups"
DANIEL ROCKMORE, *Dartmouth College; Member, School of Mathematics*

January 9
Analysis/Math Physics and Applied Math/Statistical Physics Seminar: "3D Navier-Stokes and Euler Equations with Initial Data Characterized by Uniformly Large Vorticity"
ALEX MAHALOV, *Arizona State University*

January 13
Computer Science/Discrete Math Seminar I: "Lower Bounds for Matrix Multiplication"
AMIR SHPILKA, *Harvard University* and *Massachusetts Institute of Technology*

January 14
Computer Science/Discrete Math Seminar II: "New Lattice Based Cryptographic Constructions"
ODED REGEV, *Member, School of Mathematics*

January 20
Computer Science/Discrete Math Seminar I: "A Second Threshold for the Hard-Core Model"
PETER WINKLER, *Bell Labs*

January 21
Computer Science/Discrete Math Seminar II: "Inapproximability of the Distributed Minimum Spanning Tree Problem"
MICHAEL ELKIN, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

January 24
Stochastic Analysis and Modeling Seminar: "Three Wave Interaction for Ocean Turbulence?"
ALEXANDER BALK, *University of Utah; Member, School of Mathematics*

January 27
Computer Science/Discrete Math Seminar I: "The Exact Turan Number of the Fano Plane"
PETER KEEVASH, *Princeton University*

Members Seminar: "Asymptotics of Toeplitz and Hankel Determinants"
PERCY DEIFT, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

January 28
Computer Science/Discrete Math Seminar II: "Perfect Graphs"
PAUL SEYMOUR, *Princeton University*

January 29
Aspects of Integrable Systems: "Geometric Methods in Nonlinear Dynamics: A Survey PART I: Integrable Hierarchies of Nonlinear PDEs"
EMMA PREVIATO, *Boston University; Member, School of Mathematics*

Aspects of Integrable Systems: "Geometric Methods in Nonlinear Dynamics: A Survey PART II: ACI (Algebraically Completely Integrable) Hamiltonian Systems"
EMMA PREVIATO, *Boston University; Member, School of Mathematics*

January 30
Statistical Mechanics Seminar: "SLE and Scaling Limits"
STANISLAV SMIRNOV, *Royal Institute of Technology, Sweden; Member, School of Mathematics*

February 3
Computer Science/Discrete Math Seminar I: "The Number of Directions Determined by n Points in Space"
JANOS PACH, *City College of New York* and *Renyi Institute, Budapest*

Members Seminar: "Asymptotics of Toeplitz and Hankel and Toeplitz Matrices via Riemann Hilbert Methods"
PERCY DEIFT, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

February 4
Computer Science/Discrete Math Seminar II: "Testing Large Directed Graphs"
NOGA ALON, *Tel Aviv University*

February 6
Statistical Mechanics: "Coulomb Gas Methods for 2d Critical Behavior"
JOHN CARDY, *All Souls College, University of Oxford; Member, Schools of Mathematics and Natural Sciences*

February 7
Stochastic Analysis and Modeling: "Dimensional Reduction of Mechanical Systems with Heat Bath"
RAZ KUPFERMAN, *Laurence Berkeley National Laboratory*

February 10
Computer Science/Discrete Math Seminar I:
"Coloring Products of Graphs, A Fourier Approach"
EHUD FRIEDGUT, *Hebrew University of Jerusalem*

Stochastic Modeling Seminar: "Adaptive Prediction Algorithms"
ALEXANDER CHORIN, *University of California, Berkeley*

February 11
Computer Science/Discrete Math Seminar II:
"Set-Systems with Restricted k-Wise Intersections"
BENNY SUDAKOV, *Princeton University; Member, School of Mathematics*

February 12
Aspects of Integrable Systems: "Random Characteristic Polynomials: Riemann-Hilbert Approach"
EUGENE STRAHOV, *Brunel University, England*

February 13
Princeton/IAS/Rutgers Number Theory Seminar:
"Integral Points on Algebraic Curves and Surfaces"
UMBERTO ZANNIER, *Milan*

Special Analysis Seminar: "Theory of Continuous Valuations"
SEMYON ALESKER, *Tel Aviv University and University of Chicago*

Statistical Mechanics Seminar: "Dimers on Periodic Planar Graphs"
ANDREI OKOUNKOV, *Princeton University*

February 17
Computer Science/Discrete Math Seminar I:
"Chromatic Number of the Plane and its Relatives: History, Problems, Results"
ALEXANDER SOIFER, *DIMACS, Rutgers University and University of Colorado*

Members Seminar: "How Rain Starts"
GREGORY FALKOVICH, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

February 18
Computer Science/Discrete Math Seminar II:
"Quantum Time-Space Tradeoffs for Sorting"
HARTMUT KLAUCK, *Centrum voor Wiskunde en Informatica, The Netherlands; Member, School of Mathematics*

February 20
Statistical Mechanics Seminar: "Stationary Solutions of Stochastic Differential Equations with Memory"
YURI BAKHTIN, *Institute for Advanced Study*

February 24
Computer Science/Discrete Math Seminar I:
"Approximation Complexity of MIN-BISECTION Problems"
MAREK KARPINSKI, *University of Bonn*

February 25
Computer Science/Discrete Math Seminar II:
"Systems of Linear Equations Hard for k-DNF Resolution"
ALEXANDER RAZBOROV, *Member, School of Mathematics*

February 26
Aspects of Integrable Systems: "Solitons and Many-Body Systems in Algebraic Geometry"
DAVID BEN-ZVI, *University of Chicago*

February 27
Statistical Mechanics Seminar: "Superdiffusivity of Two Dimensional Lattice Gas with Navier-Stokes Equation as the Formal Limit"
HORNG-TZER YAU, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

March 3
Computer Science/Discrete Math Seminar I:
"Coin Flipping From a Cosmic Source; or, On Error Correction of Truly Random Bits"
RYAN O'DONNELL, *Massachusetts Institute of Technology*

Conference on Stochastic Partial Differential Equations

March 4
Computer Science/Discrete Math Reading Seminar:
"Exponential Lower Bound for 2-Query Locally Decodable Codes via a Quantum Argument (on the paper by Iordanis Kerenidis and Ronald de Wolf)"
XIAODONG SUN, *Rutgers University, Piscataway; Member, School of Mathematics*

Conference on Stochastic Partial Differential Equations

March 5
Conference of Stochastic Partial Differential Equations

March 6
Conference of Stochastic Partial Differential Equations
Joint Princeton/IAS/Rutgers Analysis and Number Theory: "Combinatorial Measure Theory Problems Related to the Kakeya Conjecture"
JEAN BOURGAIN, *Professor, School of Mathematics*

March 7
Conference of Stochastic Partial Differential Equations

March 10
Computer Science/Discrete Math Seminar I: "Learning Juntas"
ROCCO SERVEDIO, *Columbia University*

Statistical Mechanics Seminar: "Branched Polymers and Dimensional Reduction"
JOHN CARDY, *All Souls College, University of Oxford; Member Schools of Mathematics and Natural Sciences*

March 11
Computer Science/Discrete Math Seminar II: "Long Arithmetic Progressions in Sumsets and Erdos-Folkman Conjecture"
VAN VU, *University of California, San Diego*

March 12
Stochastic Analysis and Modeling Seminar: "Introduction to Hydrodynamic Limit of Interacting Particle Systems"
HORNG-TZER YAU, *Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics*

March 13
Princeton/IAS/Rutgers Analysis and Number Theory Seminar: "Exceptional Zero and Prime Numbers"
HENRYK IWANIEC, *Rutgers University*

March 17
Computer Science/Discrete Math Seminar I: "Chromatic Number of the Plane and Its Relatives: History, Problems, Results"
ALEXANDER SOIFER, *DIMACS, Rutgers University and University of Colorado*

March 18
Computer Science/Discrete Math Reading Seminar: "Lower Bounds for Multi-Party Set Disjointness"
AMIT CHAKRABARTI, *Princeton University; Member, School of Mathematics*

March 19
Statistical Mechanics Seminar: "On the Spaces of Flat Connections and Diagonal Curvatures"
VLADIMIR ZAKHAROV, *Arizona University*

March 20
Conference on Turbulence

March 21
Conference on Turbulence

March 22
Conference on Turbulence

March 24
Computer Science/Discrete Math Seminar I: "Generalized Compact Knapsacks, Cyclic Lattices, and Efficient One-Way Functions from Worst-Case Complexity Assumptions"
DANIELE MICCIANCIO, *University of California, San Diego*

Computer Science/Discrete Math Seminar II: "Discrete Analytic Functions and Global Information from Local Observation"
LASLO LOVASZ, *Microsoft Research*

March 25
Computer Science/Discrete Math Seminar III: "Algebraic Constraint Satisfaction Problems"
MADHU SUDAN, *Massachusetts Institute of Technology*

Computer Science/Discrete Math Seminar IV: "List-Decoding Using the XOR Lemma"
LUCA TREVISAN, *Berkeley University*

March 26
Number Theory Seminar: "Limits of Semi-Stable Representations"
LAURENT BERGER, *Harvard University*

Aspects of Integrable Systems Seminar: "Hidden Symmetries in Integrable Systems and Dynamical Poisson Groupoids"
LUEN-CHAU LI, *Pennsylvania State University*

Aspects of Integrable Systems Seminar: "Integrable Chains on Algebraic Curves"
IGOR KRICHEVER, *Columbia University*

March 31
Computer Science/Discrete Math Seminar I:
"On the Impossibility of Dimension Reduction in l1"
BO BRINKMAN, *Princeton University*

Marston Morse Memorial Lecture: "Motivic Algebraic Topology"
FABIEN MOREL, *Institut de Mathématique de Jussieu*

Member Seminar: "How Rain Starts"
GREGORY FALKOVICH, *Weizmann Institute of Science, Israel; Member, School of Mathematics*

April 1
Computer Science/Discrete Math Seminar II:
"Extractors – Optimal Up To Constant Factors"
OMER REINGOLD, *Member, School of Mathematics*

April 2
Marston Morse Memorial Lecture: "Motivic Algebraic Topology"
FABIEN MOREL, *Institut de Mathématique de Jussieu*

April 3
Marston Morse Memorial Lecture: "Motivic Algebraic Topology"
FABIEN MOREL, *Institut de Mathématique de Jussieu*

April 4
Geometric Representation Theory Seminar:
"Homomorphisms of the Icosahedral Group into Semisimple Groups"
GEORGE LUSZTIG, *Massachusetts Institute of Technology*

April 7
Computer Science/Discrete Math Seminar I:
"Scale-Free Random Graphs"
BELA BOLLOBAS, *University of Memphis* and *University of Cambridge*

April 9
Aspects of Integrable Systems: "The Large N Expansion for a Random Matrix Partition Function"
NICK ERCOLANI, *University of Arizona, Tucson*

Aspects of Integrable Systems: "Universality of Discrete Orthogonal Polynomial Ensembles"
JINHO BAIK, *Princeton University*

April 10
Statistical Mechanics Seminar: "Passive Transport by Stochastic Flows"
DMITRY DOLGOPYAT, *Pennsylvania State University, Member, School of Mathematics*

April 14
Computer Science/Discrete Math Seminar I:
"Adding Random Edges to Dense Graphs"
MICHAEL KRIVELEVICH, *Tel Aviv University*

Special Seminar: "Global Attractors for Generalized Semiflows"
JOHN BALL, *University of Oxford; Member, School of Mathematics*

April 17
Statistical Mechanics Seminar: "Sticky Flows on the Circle"
OLIVIER RAIMOND, *Université Paris-Sud*

Stochastic Modeling Seminar: "Contact Line Singularity in Thin-Film Flows"
FELIX OTTO, *University of Bonn*

April 21
Computer Science/Discrete Math Seminar I:
"Analysis of Boolean Functions and Various Applications"
MULI SAFRA, *Tel Aviv University*

April 24
Stochastic Modeling Seminar: "Around Random Burgers on Unbounded Domains"
KOSTYA KHANIN, *Newton Institute, Cambridge University*

April 25
Statistical Mechanics Seminar: "Kraichnan Model and Stochastic Differential Equations"
YVES LE JAN, *Université Paris-Sud*

April 7
Computer Science/Discrete Math Seminar I:
"Partial Results on the Total Colouring Conjecture"
BRUCE REED, *McGill University*

Special Stochastic Modeling Seminar: "Multiscale Computation of Turbulent Flames via Asymptotic Flamelets"
ANNE BOURLIOUX, *University of Montreal*

Statistical Mechanics Seminar: "Multifractality of the SRB Measures in the Kraichnan Flow"
PETER HORVAI, *École Polytechnique* and *École Normale Supérieure de Lyon*

April 9
Aspects of Integrable Systems Seminar:
"Gromov-Witten Theory I"
ANDREI OKOUNKOV, *Princeton University*

Aspects of Integrable Systems Seminar:
"Gromov-Witten Theory II"
RAHUL PANDHARIPANDE, *Princeton University*

May 4
Stochastic Modeling Seminar: "Computational Studies of Conformational Transitions of Parts of the ATP Synthase"
PAUL MARGARAKIS, *Harvard University*

May 5
Computer Science/Discrete Math Seminar I:
"Dual-Bounded Monotone Properties"
LEONID KHACHIYAN, *Rutgers University*

May 12
Computer Science/Discrete Math Seminar I:
"Frugality in Path Auctions"
EDITH ELKIND, *Princeton University*

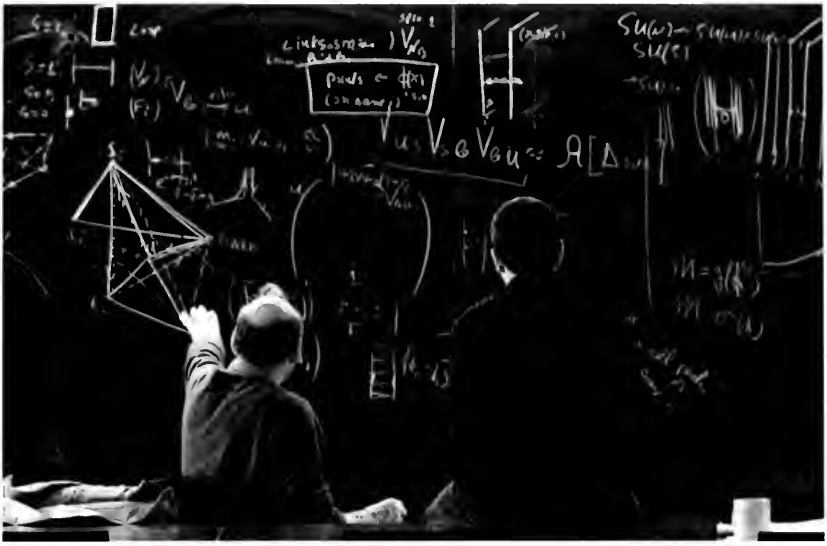
May 19
Neuroscience Day

June 2
Computer Science/Discrete Math Seminar I:
"Tracking Frequent Items Dynamically"
GRAHAM CORMODE, *DIMACS, Rutgers University*

June 3
Computer Science/Discrete Math Seminar II:
"On the Rectangle Bound in Communication Complexity"
HARTMUT KLAUCK, *Centrum voor Wiskunde en Informatica, The Netherlands; Member, School of Mathematics*

June 5
Computer Science/Discrete Math Seminar III:
"Noise-Resistant Boolean Functions Are Juntas"
GUY KINDLER, *Tel Aviv University*

June 16
Computer Science/Discrete Math Seminar I:
"Optimal Integer Arrangement on the Square Grid"
JOZSEF BALOGH, *Ohio State University*



"I had been a Member at the Institute a decade ago, but the reality proved better than my youthful memories of the place. Beyond all, it is the inspiring intellectual environment that makes this place so rare and precious."

—Member, School of Natural Sciences

Working in the Common Room, Bloomberg Hall

THE SCHOOL OF NATURAL SCIENCES

Faculty

STEPHEN L. ADLER, Particle Physics
New Jersey Albert Einstein Professor

JOHN N. BAHCALL, Astrophysics
Richard Black Professor

JUAN MALDACENA, Theoretical Physics

NATHAN SEIBERG, Theoretical Physics

EDWARD WITTEN, Mathematical Physics
Charles Simonyi Professor

Professor Emeritus

FREEMAN J. DYSON, Mathematical Physics and Astrophysics

W.M. Keck Visiting Associate in Cosmology

MATIAS ZALDARRIAGA, Astrophysics *f*

Visiting Professors

PETER GOLDREICH, Astrophysics, California Institute of Technology
ARNOLD LEVINE, Molecular Biology

ACADEMIC ACTIVITIES

PROFESSOR STEPHEN ADLER's time this year has been devoted primarily to work on fundamentals of quantum mechanics. He wrote a paper generalizing the Weisskopf-Wigner theory for the line shape and transition rates of decaying states to the case of the energy-driven stochastic Schrödinger equation. The calculation shows that the line shape is unchanged, but that the stochastic terms alter the early time transient rate of the decay in a way that eliminates the quantum Zeno effect. This result was used to place bounds on the stochasticity parameter using data from charmed meson decays. Using a simplified form of the analysis suggested by Lajos Diósi, who visited the Institute from Hungary for a month in the fall of 2002, Professor Adler also computed the stochastic modifications of the Rabi oscillations for a two-level system, which can again be used to set experimental bounds on the stochasticity parameter.

Professor Adler's main project throughout the year has been completion of a book entitled *Quantum Mechanics as an Emergent Phenomenon*, and subtitled "The Statistical Dynamics of Global Unitary Invariant Matrix Models as the Precursor of Quantum Field Theory", that is now under contract with Cambridge University Press. This book is a revised and expanded version of a draft preprinted last year on the high energy theory archive, and gives a detailed development of work by Professor Adler and collaborators over the last 8 years on the idea that the classical dynamics of non-commutative matrix variables can lead, in the statistical thermodynamic approximation, to an emergent

quantum field theory. The book also suggests that Brownian motion corrections to this thermodynamics can give an underlying justification for proposals by Ghirardi, Rimini, and Weber, by Pearle, and others, that stochastic modifications of the Schrödinger equation can give a phenomenology of state vector reduction. It is anticipated that the book will be ready for submission to the publisher around mid-June, 2003.

In the Academic year 2002-03, PROFESSOR JOHN BAHCALL worked on a clean method for measuring or limiting the cosmological time-dependence of the fine-structure constant, an empirical analysis of the energy spectrum of ultra-high energy (> 1019 eV) cosmic rays, and a series of problems related to solar neutrino physics and astronomy.

Together with C. Steinhardt and D. Spergel (of Princeton University), Bahcall developed the O III emission line method for testing the time-dependence of the fine structure constant. This method has the advantage that no assumptions need be made regarding the velocity structure of the clouds producing the emission lines and, moreover, the lines are so prominent that all of the measurements can be made algorithmically and with no ambiguities. The use of SDSS quasar spectra produced a significant limit on the time dependence of alpha, one that is free from the questionable assumptions that plague some other methods. The O III method is now being applied to more distant quasar whose higher resolution spectra are being obtained at Keck (Bahcall is the PI on one such observing proposal that was recently awarded Keck time for this purpose.).

Bahcall and Eli Waxman (Weizmann Institute of Science) analyzed the energy spectra of UHE cosmic rays from different experiments. They showed that the observed energy spectra from the Fly's Eye, Yakutsk, HiRes, Haverah Park, and AGASSA experiments are all in agreement with each other (within small adjustments of the energy scales that are consistent with the published energy uncertainties) below 5*1019 eV and, all except AGASSA, show strong evidence for the GZK cutoff above 5*1019 eV.

Together with M. C. Gonzalez-Garcia (CERN and SUNY, Stony Brook) and C. Pena-Garay (Valencia, Spain, and IAS), Bahcall wrote a series of four articles on topics related to solar neutrinos. They developed a method for determining both the total 8B neutrino flux from the Sun and the sterile component of the flux, using the fact that solar neutrino experiments determine the neutrino mixing parameters (but not the total flux), whereas the total flux and the observed rate are known for the KamLAND reactor experiment. Combining solar and reactor experiments, one can limit the sterile component of the total 8B neutrino flux. They then applied their method to the recently released KamLAND reactor data, finding a total 8B neutrino flux of 1.0 ± 0.06 times the standard solar model flux and an upper limit of 9% for the sterile fraction (at 1s). Other results include showing that only the LMA solution is allowed at 4.7s, and maximal mixing is disfavored at 3.3s. These same authors tested the standard solar model prediction that the Sun shines primarily by energy derived from nuclear reactions in the proton-proton chain, not the CNO cycle (as originally suggested by Bethe). Using all available solar and reactor experiments, they succeeded in placing an upper limit of 7.8% on the fraction of the solar luminosity that is derived from CNO reactions. This upper limit represents an order of magnitude improvement over previous limits based upon solar neutrino experimental data. In an earlier paper, Bahcall, Gonzalez-Garcia, and Pena-Garay used the publication of the SNO neutral current and charged current data to make a global analysis of all available data on solar neutrinos. In the course of this work, they introduced several

improvements in the methods of analysis that influence the allowed regions of neutrino oscillation parameter space. In addition to computing accurately the allowed regions, the authors used their results to predict the values of 10 observables that will be measured in the future by the BOREXINO, KamLAND, and SNO experiments and a generic detector of p-p solar neutrinos.

VISITING PROFESSOR PETER GOLDREICH completed several projects during the 2002-03 academic year.

Work in collaboration with Nicole Rappaport on the origin of chaos in the Prometheus-Pandora system demonstrated that the chaotic orbits of Prometheus and Pandora, two small satellites of Saturn, are due to interactions associated with their 121:118 mean motion resonance. Differential precession splits this resonance into a quartet of components equally spaced in frequency. Libration widths of the individual components exceed the splitting resulting in resonance overlap which causes the chaos. A single degree of freedom model captures the essential features of the chaotic dynamics. Mean motions of Prometheus and Pandora wander chaotically in zones of width 1.8degy^{1} and 3.1degy^{1}, respectively. These results are scheduled to be published in *Icarus*.

Professor Goldreich also worked on planet - disk symbiosis, in collaboration with Re'em Sari. Planets form in disks around young stars. Interactions with these disks cause them to migrate and thus affect their final orbital periods. We suggest that the connection between planets and disks may be deeper and involve a symbiotic evolution. By contributing to the outward transport of angular momentum, planets promote disk accretion. Here we demonstrated that planets sufficiently massive to open gaps could be the primary agents driving disk accretion. Those having masses below the gap opening threshold drift inward more rapidly than the disk material and can only play a minor role in its accretion. Eccentricity growth during gap formation may involve an even more intimate symbiosis. Given a small initial eccentricity, just a fraction of a percent, the orbital eccentricity of a massive planet may grow rapidly once a mass in excess of the planet's mass has been repelled to form a gap around the planet's orbit. Then, as the planet's radial excursions approach the gap's width, subsequent eccentricity growth slows so that the planet's orbit continues to be confined within the gap. This work will be published in *ApJ Letters*.

Professor Goldreich worked with Michael Efroimsky on gauge freedom in the N-body problem of celestial mechanics. Whenever a standard system of six planetary equations (in the Lagrange, Delaunay, or other form) is employed, the trajectory resides on a 9(N-1)-dimensional submanifold of the 12(N-1)-dimensional space spanned by the orbital elements and their time derivatives. The freedom in choosing this submanifold reveals an internal symmetry inherent in the description of the trajectory by orbital elements. This freedom is analogous to the gauge invariance of electrodynamics. In traditional derivations of the planetary equations this freedom is removed by hand through the introduction of the Lagrange constraint, either explicitly (in the variation-of-parameters method) or implicitly (in the Hamilton-Jacobi approach). This constraint imposes the condition that the orbital elements osculate the trajectory, i.e., that both the instantaneous position and velocity be fit by a Keplerian ellipse (or hyperbola). Imposition of any supplementary constraint different from that of Lagrange (but compatible with the equations of motion) would alter the mathematical form of the planetary equations without affecting the physical trajectory.

For coordinate-dependent perturbations, any gauge different from that of Lagrange makes the Delaunay system non-canonical. In a more general case of disturbances dependent also upon velocities, there exists a "generalised Lagrange gauge" wherein the Delaunay system is symplectic (and the orbital elements are osculating in the phase space). This gauge reduces to the regular Lagrange gauge for perturbations that are velocity-independent.

We provided a practical example illustrating how the gauge formalism considerably simplifies the calculation of satellite motion about an oblate precessing planet. Professor Goldreich will continue work on the origin of magnetic fields of millisecond pulsars, in collaboration with Feryal Özel; on imbalanced strong MHD turbulence, in collaboration with Yoram Lithwick; and on an explanation for the spectrum of density fluctuations in the solar wind.

VISITING PROFESSOR ARNOLD LEVINE's report for the academic year can be found in the Report for the Program in Theoretical Biology on page 122.

During the 2002-03 academic year, PROFESSOR JUAN MALDACENA researched the following topics. First, he continued to work on plane waves in string theory. These are interesting because they are non-trivial spacetimes where one can solve string theory exactly. In addition, an interesting relationship to integrable systems has been discovered. These plane waves were analyzed in lightcone gauge and it was not obvious that they solved the string equations of motion. That question was settled when it was shown, using the Berkovits formalism, that they indeed solve the equations.

Maldacena then computed the leading non-Gaussian effects in single field inflationary models. It is well known that inflation predicts a spectrum of fluctuations that is Gaussian to high accuracy. But the level of non-Gaussian effects was only crudely estimated. Maldacena computed the precise form of the non-Gaussian aspects of the primordial fluctuations. He found that in single field inflationary models they are too small (by two orders of magnitude) to be measurable by the MAP and Planck satellites. He showed the formal similarity between this computation and similar computations in Anti-de-Sitter spacetimes, which are relevant in AdS/CFT.

With M. M. Sheikh-Jabbari and M. Van Raamsdonk, Maldacena considered the problem of the transverse 5 brane in the matrix formulation of M-theory. Matrix theory is a proposal for a full description of M-theory. It has been technically hard to show that it indeed contains the 5-brane in the spectrum. In their joint paper, a concrete proposal was made for the corresponding state and some evidence given in support of the proposal.

With O. Lunin and L. Maoz, Maldacena constructed a large family of gravity solutions corresponding to supersymmetric states in AdS_3. These states are predicted by AdS/CFT and a precise gravity description was considered.

Finally, with N. Lambert and H. Liu, the problem of decaying D-branes was considered. Maldacena computed the precise nature of the closed strings that come out of decaying D-branes and proposed that these closed strings are all that remain once the tachyon decays.

Maldacena is planning to continue working on some of these problems during the rest of the academic year.

During this period, PROFESSOR NATHAN SEIBERG's work had two themes. He studied strings in time-dependent backgrounds and the dynamics of supersymmetric gauge theories.

In a series of papers with H. Liu and G. Moore, string theory in time dependent backgrounds was explored. They focused on solvable models in which classical string effects can be exactly analyzed. They formulated conditions for a time-dependent orbifold to be amenable to perturbative string analysis and classified the low-dimensional orbifolds satisfying these conditions. The simplest example they studied was a time-dependent orbifold with a null singularity. The singularity separates a contracting universe from an expanding universe, thus constituting a big crunch followed by a Big Bang.

These theories were quantized both in light-cone gauge and covariantly. They analyzed the tree and torus amplitudes of some of these orbifolds. The tree amplitudes exhibit a new kind of infrared divergences which are a result of some ultraviolet effects. These UV enhanced IR divergences can be interpreted as due to back reaction of the geometry. They argued that for this reason the three dimensional parabolic orbifold is not amenable to perturbation theory. Similarly, the smooth four dimensional null-brane tensored with sufficiently few noncompact dimensions also appears problematic. However, when the number of noncompact dimensions is sufficiently large, perturbation theory in these time-dependent backgrounds seems consistent.

The implications of these results for the Ekpyrotic/Cyclic Model were discussed.

The work of Dijkgraaf and Vafa on the interesting connection between matrix model and supersymmetric gauge theories has led to the other theme in Seiberg's work. With F. Cachazo, M.R. Douglas and E. Witten, anomalies and the chiral ring structure in a supersymmetric $U(N)$ gauge theory with an adjoint chiral superfield and an arbitrary superpotential were analyzed. A certain generalization of the Konishi anomaly leads to an equation which is identical to the loop equation of a bosonic matrix model. This has allowed them to solve for the expectation values of the chiral operators as functions of a finite number of "integration constants." From this, they derived the Dijkgraaf-Vafa relation of the effective superpotential to a matrix model. Some of their results are applicable to more general theories. For example, they determined the classical relations and quantum deformations of the chiral ring of $N = 1$ super Yang-Mills theory with $SU(N)$ gauge group, showing, as one consequence, that all supersymmetric vacua of this theory have a nonzero chiral condensate.

These theories were further studied with F. Cachazo and E. Witten. The classical theory has several vacua labeled by integers $(N_1, N_2, ..., N_k)$, with the classical unbroken gauge group $\prod_i U(N_i)$. Quantum mechanically, each classical vacuum leads to $\prod_i N_i$ different vacua. As the parameters of the classical superpotential are varied, these vacua change in a continuous (and holomorphic) fashion. They found that vacua associated with $(N_1, N_2, ..., N_k)$ can be continuously transformed to vacua with $(\tilde{N}_1, \tilde{N}_2, ..., \tilde{N}_k)$, thus leading to a new kind of duality. Traditional order parameters, like the Wilson loop and 't Hooft loop, sometimes distinguish different phases. They also found phases that are not distinguished by conventional order parameters. The whole picture of the phase diagram is reminiscent of the phase diagram of M-theory.

These theories were generalized by the inclusion of matter fields in the fundamental and anti-fundamental representations. This theory can also be described by a matrix model. In particular, the anomaly equations in the gauge theory were identified with the loop equations in the matrix model.

The theories with fundamental matter were further analyzed with F. Cachazo and E. Witten, who solved for the expectation values of all chiral operators. A simple geometric picture emerged involving a description by a meromorphic one-form on a Riemann surface. The equations of motion are equivalent to a condition on the integrality of periods of this form. The solution indicates that all semiclassical phases with the same number of $U(1)$ factors are continuously connected.

In the Academic Year 2002-03, PROFESSOR EDWARD WITTEN wrote with co-authors a series of three papers on supersymmetric gauge theories. The first paper, written with F. Cachazo, M. Douglas, and N. Seiberg, obtained an explanation using anomalies of results by R. Dijkgraaf and C. Vafa relating gauge theories to matrix models. The last two papers, with Cachazo and Seiberg, uncovered many interesting physical properties of these theories, such as the role of confinement, oblique confinement, and the Higgs mechanism in the exact nonperturbative solution and the possibility of smoothly interpolating between vacua that from a classical point of view have different gauge groups.

With a graduate student, T. Freedman, Witten computed the threshold corrections to grand unification in M-theory on a manifold of G_2 holonomy. With I. Klebanov, he has estimated the proton lifetime in a certain class of orientifold compactifications of Type II superstrings — regrettably learning that it is apparently a little too long to be measured in the next generation of detectors. Witten has also completed a paper with a student, C. Beasley, giving a new explanation of surprising old results about cancellations among heterotic string worldsheet instantons.

Finally, he has investigated a natural group of transformations among three-dimensional conformal field theories with global symmetries.

PROFESSOR EMERITUS FREEMAN DYSON spent much of the year traveling and lecturing, and writing reviews and prefaces for other people's books. He served as a member of the NASA Advisory Council, helping to ensure that the excellent NASA program of unmanned science missions will not be damaged by the disasters that have overtaken the NASA manned mission programs. In the limited time that he spends thinking about physics, he is concerned with the question, whether the concept of quantum gravity has any operational meaning. Is it possible to devise a thought-experiment by which the existence of individual gravitons could be detected?

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THE SCHOOL OF NATURAL SCIENCES

RECORD OF EVENTS

The following is a calendar of events sponsored by
the School of Natural Sciences

Academic Year 2002-03

September 14
Astrophysics Seminar: "Physics with Supernovae"
GEORG RAFFELT, *Max Planck Institute for Physics*

September 17
Astrophysics Seminar: "When Was the Universe Reionized?"
AVI LOEB, *Institute for Advanced Study* and *Harvard University*

September 18
Astrophysics Seminar: "Small-Scale Structure in Lens Galaxies"
CHARLES KEETON, *University of Chicago*

September 24
Astrophysics Seminar: "The 2dF Galaxy Redshift Survey: Cosmological Parameters and Galaxy Biasing"
OFER LAHAV, *Institute of Astronomy, University of Cambridge*

September 25
Astrophysics Seminar: "Studying the Reionization of the Universe with Recent and Future Observations"
RENNAN BARKANA, *Tel Aviv University*

September 30
High Energy Theory Seminar: "Supersymmetric SU(5)xSU(5): Unifying the Ununified Standard Model"
GRAHAM KRIBS, *University of Wisconsin, Madison*

October 1
Astrophysics Seminar: "DASI CMB Polarization Measurements"
JOHN CARLSTROM, *University of Chicago*

October 4
High Energy Theory Lunchtime Seminar: "N=1 and N=2 Field Theory Results from Fluxes"
FREDDY CACHAZO, *Institute for Advanced Study*

October 8
Astrophysics Seminar: "Kuiper Belt Binaries: A New Window on Runaway Accretion"
PETER GOLDREICH, *Institute for Advanced Study* and *California Institute of Technology*

October 9
Astrophysics Seminar: "Occultation and Microlensing"
ERIC AGOL, *California Institute of Technology*

Astrophysics Seminar: "Neutrino Oscillations: A Summary"
CARLOS PEÑA-GARAY, *Institute for Advanced Study*

October 10
Physics Group Meeting: "Adding Flavors to AdS/CFT with Supergravity Solution of Localized Brane Intersections"
AKIKAZU HASHIMOTO, *Institute for Advanced Study*

October 14
High Energy Theory Seminar: "New Results in Topological Open String Theory"
MICHAEL DOUGLAS, *Rutgers University*

October 15
Astrophysics Seminar: "Star Formation Thresholds and Galaxy Edges"
JOOP SCHAYE, *Institute for Advanced Study*

October 16
Joint Physics/Astrophysics Seminar: "Gamma-Ray Bursts: The Brightest Explosions in the Universe"
AVI LOEB, *Institute for Advanced Study* and *Harvard University*

Astrophysics Seminar: "Energetics and Intrinsic Timescales of Gamma-Ray Burst Triggers"
ENRICO RAMIREZ-RUIZ, *Institute of Astronomy*

October 17
Astrophysics Seminar: "Lightning Up the Dark Matter: The Galaxy – Dark Matter Connection"
FRANK VAN DEN BOSCH, *Max Planck Institute*

Physics Group Meeting: "Properties and Problems of 4-D Gravity on a Brane in 5-D Minkowski Space"
MASSIMO PORRATI, *Institute for Advanced Study and New York University*

October 18
High Energy Theory Lunchtime Seminar: "A String Theory of Hadrons via a Penrose Limit"
LEOPOLDO PANDO ZAYAS, *Institute for Advanced Study and University of Michigan, Ann Arbor*

October 22
Astrophysics Seminar: "Non-Thermal Emission from Structure Formation"
ELI WAXMAN, *Weizmann Institute of Science, Israel*

October 23
Astrophysics Seminar: "The End of the Dark Ages: The Formation of the First Stars and Quasars"
VOLKER BROMM, *Harvard-Smithsonian Center for Astrophysics*

Joint Physics/Astrophysics Seminar: "Inflation"
JUAN MALDACENA, *Institute for Advanced Study*

October 24
Astrophysics Papers Discussion Group: "Formation of Galaxies and Clusters of Galaxies by Self-Similar Gravitational Condensation" by Press & Schechter (1974)

Particle Physics Phenomenology Discussions: "Gauge Mediation of Supersymmetry Breaking"
SCOTT THOMAS, *Stanford University*

Physics Group Meeting: "Lepton Flavor Violating Processes in Discrimination of the Models of Physics Beyond the Standard Model"
RYUICHIRO KITANO, *Institute for Advanced Study*

October 25
High Energy Theory Seminar: "Null-Branes and Time Dependence in String Theory"
JOAN SIMON SOLER, *Weizmann Institute of Science, Israel*

October 30
Joint Physics/Astrophysics Seminar: "Cosmic Rays and the GZK Cutoff"
ELI WAXMAN, *Weizmann Institute of Science, Israel*

October 31
Astrophysics Papers Discussion Group: "Black Holes in Binary Systems. Observational Appearance" by Sakura & Sunyaev (1973)

November 1
High Energy Theory Lunchtime Seminar: "Non-Planar Anomalies in Noncommutative Theories and the Green-Schwarz Mechanism"
ADI ARMONI, *CERN Theory Division*

November 5
Astrophysics Seminar: "Force-free Electrodynamics and Ultrarelativistic Astrophysical Flows"
ROGER BLANDFORD, *California Institute of Technology*

November 6
Astrophysics Seminar: "Probing the State and Composition of the Intergalactic Medium"
STEVEN FURLANETTO, *Harvard Center for Astrophysics*

Joint Physics/Astrophysics Seminar: "Inflation, Part II"
JUAN MALDACENA, *Institute for Advanced Study*

November 7
Astrophysics Papers Discussion Group: "Primordial Helium Abundance and the Primordial Fireball. II" by Peebles (1966)

November 8
High Energy Theory Lunchtime Seminar: "Supersymmetry, Axions, and Cosmology"
MICHAEL DINE, *University of California, Santa Cruz*

November 11
Astrophysics Seminar: "Entropy in the Intracluster Medium: 'Where's the Kaboom? There Was Supposed to be an Earth-Shattering Kaboom!' "
ARIF BABUL, *University of Victoria*

High Energy Theory Seminar: "Adventures Beyond the Operator Product Expansion"
MATTHIAS NEUBERT, *Cornell University*

November 12
Astrophysics Seminar: "CMB Anisotropy: Recent and Future Milestones"
WAYNE HU, *University of Chicago*

Analysis-Mathematical Physics Seminar: "MHD Turbulence"
PETER GOLDREICH, *Institute for Advanced Study and California Institute of Technology*

November 13
Astrophysics Seminar: "Neutrino Flux Predictions for Known Galactic Microquasars"
DAFNE GUETTA, *Osservatorio Astrofisico Arcetri*

Joint Physics/Astrophysics Seminar: "What Can CMB and Other Cosmological Observations Tell Us About The Early Universe"
UROS SELJAK, *Princeton University*

November 14
Astrophysics Papers Discussion Group: "The Maximum Mass of Ideal White Dwarfs" by Chandrasekhar (1931) and "On Massive Neutron Cores" by Oppenheimer & Volkoff (1939)

Physics Group Meeting: "Geometries Dual to Chiral Primaries in AdS_3/CFT_2 Correspondence"
OLEG LUNIN, *Institute for Advanced Study*

November 19
Astrophysics Seminar: "Formation of Supermassive Black Holes: Simulations in General Relativity"
STU SHAPIRO, *University of Illinois, Urbana-Champaign*

November 20
Astrophysics Seminar: "The Star Formation History of SDSS Galaxies and the Equation of State of Dark Energy"
RAUL JIMENEZ, *University of Pennsylvania*

November 21
Astrophysics Papers Discussion Group: "Neutrino Oscillations In Matter" by Wolfenstein (1978)

Physics Group Meeting: "Gauge Mediation with Split Messengers and the Higgs Boson Mass in Supersymmetric Theories"
SCOTT THOMAS, *Stanford University*

November 25
High Energy Theory Seminar: "M-Theory Action and Gauss Law for Manifolds with Boundary"
GREG MOORE, *Rutgers University*

December 3
Astrophysics Seminar: "OGLE Highlights"
BOHDAN PACZYNSKI, *Princeton University*

December 4
Astrophysics Seminar: "Cosmic Magnification"
BRICE MENARD, *Max Planck Institute*

December 6
High Energy Theory Lunchtime Seminar: "D-Branes in the PP-Wave Background"
MATTHIAS GABERDIEL, *Institute for Advanced Study and King's College, London*

December 9
Astrophysics Seminar: "Supernovae in Galaxy Clusters"
AVISHAY GAL-YAM, *Tel Aviv University*

High Energy Theory Seminar: "Spacetime Energy Decreases Along Worldsheet RG Flow"
SHIRAZ MINWALLA, *Harvard University*

December 11
Joint Physics/Astrophysics Seminar: "A Simple Physicist's Approach to Complex Problems"
SHMUEL NUSSINOV, *Tel Aviv University*

December 12
Astrophysics Papers Discussion Group: "Pulsar Electrodynamics" by Goldreich & Julian (1969)

Physics Group Meeting: "Chiral Rings, Anomalies, and Matrices"
NATHAN SEIBERG, *Institute for Advanced Study*

January 8
Astrophysics Seminar: "Mapping the Dark Matter: Mass Selected Galaxy Clusters from Weak Lensing"
JOSEPH F. HENNAWI, *Princeton University*

January 15
Astrophysics Seminar: "Galaxy Formation: The Reionization Years"
MICHAEL SANTOS, *California Institute of Technology*

January 22
Astrophysics Seminar: "The Nearest and Farthest Supermassive Black Holes in the Universe"
AVI LOEB, *Institute for Advanced Study* and *Harvard University*

January 28
Astrophysics Seminar: "Does the Fine Structure Constant Depend upon Cosmological Epoch?"
JOHN BAHCALL, *Institute for Advanced Study*

January 30
Physics Group Meeting: "Solving Matrix Model Using Holomorphy"
DAVID BERENSTEIN, *Institute for Advanced Study*

January 31
High Energy Theory Lunchtime Seminar: "Gravitational Instantons of D Type"
SERGEY CHERKIS, *Institute for Advanced Study*

February 3
High Energy Theory Seminar: "A Little Higgs from a Simple Group"
MARTIN SCHMALTZ, *Boston University*

February 4
Astrophysics Seminar: "Is LELUYA, Goddess of Lightning, Also a Goddess of Multidimensional Radiative Transfer?"
DEJAN VINKOVIC, *University of Kentucky*

Astrophysics Seminar: "The Human Genome for Physicists and Astronomers"
ARNOLD LEVINE, *Institute for Advanced Study*

February 5
Astrophysics Seminar: "X-ray Spectroscopy of the Isolated Neutron Star 1E1207.4-5209: Atmospheric Composition and Equation of State"
KAYA MORI, *Columbia University*

February 6
Physics Group Meeting: "Lightcone Supergravity on PP-Wave and Correspondence to the Super-Yang-Mills Theory"
JAEMO PARK, *Pohang University of Science and Technology*

February 7
High Energy Theory Lunchtime Seminar: "Dynamical Wavefunction Collapse: Getting Quantum Theory to Describe Reality"
PHILIP PEARLE, *Hamilton College*

February 11
Astrophysics Seminar: "The Star Formation History of the Universe"
LARS HERNQUIST, *Harvard-Smithsonian Center for Astrophysics*

February 13
Astrophysics Seminar: "MHD of GRB Jets"
NEKTARIOS VLAHAKIS, *University of Chicago*

February 14
High Energy Theory Seminar: "High-Spin Operators and Their Duals"
IGOR KLEBANOV, *Institute for Advanced Study* and *Princeton University*

February 18
High Energy Theory Seminar: "Families of N=2 Strings"
ZHENG YIN, *CERN*

February 19
Astrophysics Seminar: "Dark Matter Cusps and Bars"
JERRY SELLWOOD, *Institute for Advanced Study* and *RutgersUniversity*

February 20
Physics Group Meeting: "Introduction to SLE for Theoretical Physicists"
JOHN CARDY, *Institute for Advanced Study* and *Oxford University*

February 25
Astrophysics Seminar: "Feeding Black Holes"
DAVID MERRITT, *Rutgers University*

February 27
Physics Group Meeting
STEPHEN SHENKER, *Stanford University*

February 28
High Energy Theory Lunchtime Seminar: "Behind the Horizon with AdS/CFT"
STEPHEN SHENKER, *Stanford University*

March 3
High Energy Theory Seminar: "De Sitter Vacua in String Theory"
SHAMIT KACHRU, *Stanford University*

March 4
Astrophysics Seminar: "Probing Active Galactic Nuclei with High Resolution X-ray Spectroscopy"
CLAUDE CANIZARES, *Massachusetts Institute of Technology*

March 5
Astrophysics Seminar: "Large Angle CMB Polarization as Reionizationometer"
GIL HOLDER, *Institute for Advanced Study*

March 6
Physics Group Meeting: "Closed Strings from Decaying D-Branes"
JUAN MALDACENA, *Institute for Advanced Study*

March 11
Astrophysics Seminar: "Spectroscopy of 10^5 Galaxies: Implications for Cosmic Gastro-Physics"
TIM HECKMAN, *Johns Hopkins University*

March 12
Astrophysics Seminar: "Reionization of Hydrogen and Helium by Early Stars and Quasars"
STUART WYITHE, *University of Melbourne*

March 13
Physics Group Meeting: "Reviews of Recent Work on Gödel Universes"
ERIC GIMON, *Institute for Advanced Study*

March 14
High Energy Theory Lunchtime Seminar: "Geometries Dual to Chiral Primaries"
OLEG LUNIN, *Institute for Advanced Study*

March 17
High Energy Theory Seminar: "The Wave Function of a 3-Dimensional Universe"
SERGEI GUKOV, *Harvard University*

March 20
Physics Group Meeting: "The Closed String Tachyons of Nonsupersymmetric Orbifolds"
RUTH BRITTO, *Institute for Advanced Study*

March 21
High Energy Theory Lunchtime Seminar: "The Higgs Boson Mass in Supersymmetric Theories"
TIANJUN LI, *Institute for Advanced Study*

March 25
Astrophysics Seminar: "The Formation of Massive Stars"
CHRIS MCKEE, *University of California, Berkeley*

March 26
Astrophysics Seminar: "Dark Matter Structure and Luminous Matter Morphology"
AMR EL-ZANT, *University of Kentucky*

March 27
Physics Group Meeting: "Cosmological Backgrounds from Compactifications of *-theories"
KLAUS BEHRNDT, *Albert Einstein Institute for Advanced Study*

March 31
High Energy Theory Seminar: "S-Brane Thermodynamics"
ALEXANDER MALONEY, *Harvard University*

April 1
Astrophysics Seminar: "From Sgr A* to the Dark Halo: New Results On Galactic Structure"
ANDY GOULD, *Ohio State University*

April 2
Astrophysics Seminar: "Death in the Dark Ages: The First Supernova Explosions"
VOLKER BROMM, *Harvard-Smithsonian Center for Astrophysics*

April 3
Physics Group Meeting: "Phases of N=1 Supersymmetric Gauge Theory with Flavors"
BO FENG, *Institute for Advanced Study*

April 4
High Energy Theory Lunchtime Seminar: "Are Supersymmetric Compactifications Unstable?"
GARY HOROWITZ, *University of California, Santa Barbara*

April 8
Astrophysics Seminar: "The First Billion Years: A Snapshot of Fast Evolving Knowledge and Theoretical Speculations"
PIERO MADAU, *University of California, Santa Cruz*

April 9
Astrophysics Seminar: "Magnetic Reconnection"
RUSSELL KULSRUD, *Princeton University*

April 10
Physics Group Meeting: "Particles and Strings: A Route to the Six-Dimensional (2, 0)-Theories"
MANS HENNINGSON, *Chalmers University*

April 14
Astrophysics Seminar: "Mars, Panspermia, and the Origin of Life: Where Did It All Begin?"
JOSEPH KIRSCHVINK, *California Institute of Technology*

High Energy Theory Seminar: "Evidence for Existence of S-Matrix for Strings on Plane Waves"
MOHAMMAD SHEIKH-JABBARI, *Stanford University*

April 15
Astrophysics Seminar: "Oscillating Neutrinos from Heaven and Earth"
CONCEPCION GONZALEZ-GARCIA, *State University of New York, Stony Brook*

April 16
Astrophysics Seminar: "Extrasolar Meteors"
NORM MURRAY, *CITA*

April 17
Astrophysics Seminar: "Manifest CP Violation from Neutrino Majorana Phases?"
ANDRE DE GOUVEA, *Fermilab*

Physics Group Meeting: "Black Holes in Gödel Universes and PP-Waves"
AKIKAZU HASHIMOTO, *Institute for Advanced Study*

April 21
Astrophysics Seminar: "On the Stellar Content of the Galactic Center"
MILOS MILOSAVLJEVIC, *California Institute of Technology*

April 22
Astrophysics Seminar: "Planetary Pinballs"
RE'EM SARI, *California Institute of Technology*

April 23
Astrophysics Seminar: "The Implications of WMAP Results for Inflation"
HIRANYA PEIRIS, *Princeton University*

April 24
Physics Group Meeting: "Twistors in Higher Dimensions"
SERGEY CHERKIS, *Institute for Advanced Study*

April 28
High Energy Theory Seminar: "Spacelike Branes and Timelike Liouville Theory"
MICHAEL GUTPERLE, *Stanford University*

April 29
Astrophysics Seminar: "Thermal and Nuclear Evolution of Accreting White Dwarfs"
LARS BILDSTEN, *Institute for Theoretical Physics, University of California*

April 30
Astrophysics Seminar: "Transport in the Asteroid Belt: Kirkwood Gaps, Stable Chaos, and Local Integrals of Motion"
HARRY VARVOGLIS, *University of Thessaloniki*

May 1
Physics Group Meeting: "Natural Framework for Bi-Large Neutrino Mixing"
STUART RABY, *Institute for Advanced Study* and *Ohio State University*

May 2
High Energy Theory Lunchtime Seminar: "Phenomenology of the Minimal SO(10) SUSY Model"
STUART RABY, *Institute for Advanced Study* and *Ohio State University*

May 5
High Energy Theory Seminar: "Strings from Tachyons"
HERMAN VERLINDE, *Princeton University*

May 6
Astrophysics Seminar: "In a Spin: The Origin and Fate of Neutron Star Rotation"
BRYAN GAENSLER, *Harvard University*

May 7
Physics Group Meeting: "Brane-Localized Kinetic Terms in the Randall-Sundrum Model"
HOOMAN DAVOUDIASL, *Institute for Advanced Study*

May 11-13
Neutron Stars on Fire: Thermonuclear Probes of Rotation, Magnetism, and Nuclear Physics Conference

[illegible]
High Energy Theory Seminar: "On Supersymmetric Space Forms"
JOSE FIGUEROA-O'FARRILL, *University of Edinburgh*

[illegible]
Astrophysics Seminar: "A Correlation of the Cosmic Microwave Sky with Large Scale Structure"
STEPHEN BOUGHN, *Haverford College*

[illegible]
High Energy Theory Lunchtime Seminar: "Large-N Collective Fields and Holography"
SUMIT DAS, *University of Kentucky*

May 20
Astrophysics Seminar: "Stellar-mass Black Holes as X-ray Sources"
NICK KYLAFIS, *University of Crete*

May 22
Physics Group Meeting: "From Free Fields to AdS"
RAJESH GOPAKUMAR, *Institute for Advanced Study*

May 27
High Energy Theory Seminar: "Comparing Strings in AdS(5)xS(5) to Planar Diagrams for Wilson Loops"
KONSTANTIN ZAREMBO, *Uppsala University*

May 29
Physics Group Meeting: "Two-Dimensional String Theory and D-Branes"
IGOR KLEBANOV, *Institute for Advanced Study* and *Princeton University*

[illegible]
Astrophysics Seminar: "Cooling, Heating, and Conduction in Galaxy Clusters"
MARCUS BRUGGEN, *International University Bremen*

June 11
Astrophysics Seminar: "Save the Sky: Topics in Sky Monitoring"
ROBERT NEMIROFF, *Michigan Tech University*

June 17
Astrophysics Seminar: "Soft Gamma Repeater Burst Activity in Anomalous X-ray Pulsars"
PETER WOODS, *NASA*

June 19
Astrophysics Seminar: "Observable Consequences of SUSY Leptogenesis"
SASHA DAVIDSON, *Institute for Particle Physics Phenomenology, University of Durham*

June 27
High Energy Theory Special Seminar: "Unity of Elementary Particles and Forces in Higher Dimensions"
SATYANARAYAN NANDI, *Oklahoma State University*

"I completed a draft of my main book project ... most of the work is done. This book has been on my agenda for several years, but if I'd been on my home campus this past year, the book would still be just scattered fragments. Another book manuscript ... had been in fragmentary form as of last summer. This past year I finished assembling the pieces, edited them, and now have a completed manuscript under consideration by three publishers."

—Member, School of Social Science

2002–2003 was the second year of the School of Social Science's three-year focus on ethical issues. Shown above are participants in a seminar on the topic of corruption and its opposites: civic virtue, public responsibility, and bureaucratic rationality. From left to right Jennifer Hasty, John Gerring, Professor Emeritus Albert O. Hirschman, Brenda Chalfin, Rasma Karklins, Professor Michael Walzer, Madeline Kochen, Michael Johnston, Ofrit Liviatan, Neil Englehart, Malgosia Madajewicz, Joao Biehl, and Philip Bond

THE SCHOOL OF SOCIAL SCIENCE

Faculty

ERIC S. MASKIN, *Albert O. Hirschman Professor*
JOAN W. SCOTT, *Harold F. Linder Professor*
MICHAEL WALZER, *UPS Foundation Professor*

Professors Emeriti

ALBERT O. HIRSCHMAN
CLIFFORD GEERTZ

Visiting Associate Professor

ADAM ASHFORTH

ACADEMIC ACTIVITIES

The School of Social Science invited nineteen scholars from a pool of 112 applicants from the United States and abroad to be part of the School's scholarly community as Members for the 2002-03 academic year. Seven visitors and two research assistants also participated in the year's activities. The National Endowment for the Humanities partially or fully funded three Members, while two Members were funded with Frederick Burkhardt Fellowships through the American Council of Learned Societies. Economists were supported by a grant from the Andrew W. Mellon Foundation, as well as the Richard B. Fisher and the Deutsche Bank Memberships. Fields of inquiry of the group included anthropology (five), economics (seven), history (four), philosophy (one), political science (eight), and sociology (three).

The thematic focus for 2002-03 was "Politics and Ethics: The Case of Corruption." Faculty and visiting Members explored a range of issues related to corruption in political and economic life, in public and private settings, in Western Europe and North America, in the former communist states, and in what used to be called the "Third World." They also addressed the questions: What is the opposite of corruption? What is the positive description of a non-corrupt or less-corrupt state or society?

The School conducted three seminar series – the Social Science Thursday Luncheon Seminar, the Corruption Thematic Seminar (which extended into a summer seminar on corruption), and the IAS/Princeton University Economics Workshop – and continued publication of its Occasional Papers and Economics Working Papers Series.

VISITING ASSOCIATE PROFESSOR ADAM ASHFORTH presented papers at Princeton University in the African Studies Program and at Harvard University in the Radcliffe Institute for Advanced Study, published an essay entitled "AIDS and Witchcraft in Post-Apartheid South Africa" (in *The State and its Margins: Comparative Ethnographies*, Veena Das and Debbie Poole), and completed a book entitled *Witchcraft*,

Violence, and Democracy in Post-Apartheid South Africa. He continued working with researchers from Princeton University on a research project funded by the National Institutes of Health entitled "Poverty, Inequality, and Health in Economic Development" (NIH Grant R01 AG20275-01) studying health, economic well-being, and community relations in South Africa. He also began a new research project examining law, governance, and the limits of state regulatory authority in post-colonial contexts.

PROFESSOR EMERITUS CLIFFORD GEERTZ received an honorary doctorate of laws from Colby College in June 2003. His work was the subject of a Presidential symposium at the American Anthropological Association in November 2002; the proceedings will be published, together with his response, as *Interrogating Geertz*, Schweder, R. and B. Goode, eds., Fall 2003. A conference on his book *Local Knowledge* was held at the University of Virginia, May 2003. He was a visitor at the University of Michigan Law School during the Spring 2003. He published several essay reviews in the *New York Review of Books* and the *New Republic*, and various scholarly essays, including "An Inconstant Profession: The Anthropological Life in Interesting Times," in *Annual Review of Anthropology*, 2002. An interview with him, by N. Panourgia, appeared in *Anthropological Theory*, 2002.

Throughout the 2002-03 academic year, PROFESSOR EMERITUS ALBERT O. HIRSCHMAN continued to monitor the political economy of developing nations (particularly those of Latin America) with daily examination of the unfolding political climate of Brazil. His interest in the analysis of the sociopolitical/economic progress of emergent populations was acknowledged this year with the conferment of two honorary degrees and several publications.

On June 6, 2002, Professor Hirschman was awarded an honorary Doctor of Laws degree from Harvard University. The honor, presented at Harvard's 351st Commencement ceremony, was bestowed in recognition of his long career of "trespassing boldly across scholarly domains, developing insights into developing societies," and named him "a splendid social scientist with a bias for hope and a passion for the possible."

On October 4, 2002, Professor Hirschman was one of three scholars presented with an *honoris causa* from the European University Institute in Florence, Italy. It was the first occasion that honorary degrees had been presented in the 25-year history of the EUI, a doctoral and postdoctoral institution committed to the study of Europe and its relations with the rest of the world.

This year also saw several additional translations and reprintings of Professor Hirschman's works, among them a Greek language edition of *Exit, Voice, and Loyalty* (Papazisis Publishers, Athens: 2002); a reprinting of the 1982 Italian edition of *Exit, Voice and Loyalty* (RCS Libri's Studio Bompiani, Milan: 2002); a Chinese edition of *The Rhetoric of Reaction* (The Journalist, Taiwan: 2002); and several additional editions — Greek, Chinese, Czech, Lithuanian, Slovene — of *The Passions and the Interests*.

In addition to these many recently translated editions of his own works, a book on the subject of Professor Hirschman's political-economic theories was also published this academic year in France under the title, *L'enquête inachevée: Introduction à l'économie politique d'Albert O. Hirschman*. The book was written by Ludovic Frobert and Cyrille Ferraton and was published in January of 2003.

In July 2002, PROFESSOR ERIC MASKIN gave the keynote address at the Economic Design Conference at New York University on the subject of the 2002 U.K. Carbon Emissions auction, which he was involved in designing. He also spoke on this topic at the 2002 International Game Theory conference at SUNY Stony Brook and the 2003 meeting of the American Economic Association in Washington, D.C., as well as in talks at the University of Toulouse and the Catholic University of Louvain. He gave a graduate course on auction theory at Princeton University in Spring 2003.

Professor Maskin lectured on the benefits and drawbacks of making government officials more accountable at Harvard-MIT, the University of Pittsburgh, the University of Florida, the University of North Carolina at Chapel Hill, New York University, UCLA, the University of Michigan, the University of Paris, Rutgers University, and California Institute of Technology. He gave talks on the subject of majority rule as an election method at conferences in Louvain, the University of Rochester, and Málaga, Spain.

In February 2003, Professor Maskin was named a Monash Distinguished Visiting Scholar in a ceremony in Melbourne, Australia, where he spoke on "Globalization and Inequality." In January 2003, he began his service as president of the Econometric Society and delivered the presidential address in Chicago in June.

PROFESSOR JOAN SCOTT is completing her book project on *le mouvement pour la parité* in late twentieth-century France. She lectured at the University of Maine (Orono), Harvard University, Johns Hopkins University, the University of Bern (Switzerland), and the University of Zagreb (Croatia). She gave papers at the meetings of the American Historical Association and at the Interuniversity Center in Dubrovnik (Croatia). Professor Scott served as the School of Social Science's representative on the search committee for the Institute directorship. She continues as a senior fellow of the School of Criticism and Theory; as an adjunct professor in history at Rutgers University; and as the chair of the Committee on Academic Freedom and Tenure of the American Association of University Professors.

During the academic year 2002-03, PROFESSOR MICHAEL WALZER gave the Millennium Lecture at Delhi University in India, the Hesburgh Lectures at the University of Notre Dame, and the Feibel Lecture at Ohio State University; he also lectured at the University of Wisconsin, Milwaukee, the University of Chicago, Loyola University, Indiana University, Princeton University, the New School, New York University, Columbia Law School, DePauw University, the City University of New York, Georgetown University, the U.S. Naval Academy, and Tel Aviv University (where he also received an honorary degree). The second volume (of four projected) of *The Jewish Political Tradition*, entitled *Membership*, was published by Yale University Press. New collections of his essays appeared in Italian under the title *Il Filo della Politica* and in German under the title *Erklärte Kriege-Kriegserklärungen*. His Horkheimer Lectures, published in German in 1999, appeared in Italian. His book *On Toleration* came out in a Roumanian edition.

THE SCHOOL OF SOCIAL SCIENCE

MEMBERS, VISITORS, AND RESEARCH STAFF

LAHOUARI ADDI
Anthropology
Institut d'Études Politiques

ROLAND BENABOU
Economics
Princeton University · MF

JOÃO BIEHL
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Princeton University

JOSEPH BLASI
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Rutgers University · *v*, *s*

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Lafayette College

JOHN GERRING
Political Science
Boston University

JAN GOLDSTEIN
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University of Chicago · *v*

JENNIFER HASTY
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Pacific Lutheran University

DAGMAR HERZOG
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Michigan State University · *b*

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Colgate University · *n*

RASMA KARKLINS
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University of Illinois, Chicago

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Tufts University · *v*

MALGOSIA MADAJEWICZ
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Columbia University · *v*

SANKAR MUTHU
Political Science
New School for Social Research · *n*

ANDREW NEWMAN
Economics
University College London · MF

CLAUDE ROSENTAL
Sociology
École des Hautes Études en Sciences Sociales

GARY SAXONHOUSE
Economics
University of Michigan · *v*

ILYA SEGAL
Economics
Stanford University · MF

ROBERTO SERRANO
Economics
Brown University

a Research Assistant · *b* Burkhardt Fellow · *f* First Term · *jv* Joint Visitor with Historical Studies · MF Supported by the Andrew W. Mellon Foundation · *n* Supported by the National Endowment for the Humanities · *s* Second Term · *v* Visitor

WILLIAM SEWELL
History
University of Chicago · *n*

MATEO TAUSSIG-RUBBO
Anthropology
University of Chicago · *v, s*

RALPH THAXTON, Jr.
Political Science
Brandeis University · *f*

MICHAEL THOMPSON
Philosophy
University of Pittsburgh · *b*

a Research Assistant · *b* Burkhardt Fellow · *f* First Term · *jv* Joint Visitor with Historical Studies · *MF* Supported by the Andrew W. Mellon Foundation · *n* Supported by the National Endowment for the Humanities · *s* Second Term · *v* Visitor

THE SCHOOL OF SOCIAL SCIENCE

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Social Science

Academic Year 2002-2003

September 30
IAS/Princeton University Economics Workshop:
"Strategic Pre-commitment in House Location Choices"
MICHAEL D. WHINSTON, *Northwestern University*

October 1
Social Science Thursday Luncheon Seminar:
Organizational meeting followed by an open discussion on the question of war with Iraq
MICHAEL WALZER, *Professor, School of Social Science*

October 7
IAS/Princeton University Economics Workshop:
"Partners: Assortative Matching with Nontransferabilities"
ANDREW NEWMAN, *University College, London; Member, School of Social Science*

October 8
Social Science Thursday Luncheon Seminar:
"Mathematical Logic as a Field for Sociological Investigation: Starting with the Sociology of a Theorem"
CLAUDE ROSENTAL, *Centre National de la Recherche Scientifique; Member, School of Social Science*

October 14
IAS/Princeton University Economics Workshop:
"Bounded Rationality and Socially Optimal Limits on Choice: An Example"
EYTAN SHESHINSKI, *The Hebrew University of Jerusalem*

October 16
Corruption Thematic Seminar: "Political Institutions and Corruption: The Role of Parliamentarism and Unitarism"
JOHN GERRING, *Boston University; Member, School of Social Science*

October 17
Social Science Thursday Luncheon Seminar:
"Comparing Corruption: Participation, Institutions, and Development"
MICHAEL JOHNSTON, *Colgate University; Member, School of Social Science*

October 21
IAS/Princeton University Economics Workshop:
"Coordination Failures and the Lender of Last Resort: Was Bagehot Right After All?"
XAVIER VIVES, *INSEAD* (with Jean-Charles Rochet)

October 24
Social Science Thursday Luncheon Seminar:
"Globalization in the Age of Enlightenment: The Case of Diderot"
SANKAR MUTHU, *New School for Social Research; Member, School of Social Science*

October 28
IAS/Princeton University Economics Workshop:
"Cooperation with Mistakes: The Stochastic Stability of Edgeworthian Recontracting"
ROBERTO SERRANO, *Brown University; Member, School of Social Science*

October 30
Corruption Thematic Seminar: "Anti-Corruption Incentives and Constituencies in the Post-Communist Region"
RASMA KARKLINS, *University of Illinois, Chicago; Member, School of Social Science*

October 31
Social Science Thursday Luncheon Seminar:
"Sex After Fascism: West Germany, 1945-1953"
DAGMAR HERZOG, *Michigan State University; Member, School of Social Science*

November 4
IAS/Princeton University Economics Workshop:
"Preventing Crime Waves"
PHILIP BOND, *Northwestern University; Member, School of Social Science*

November 6
School of Social Science Lecture: "The Missing Sentence: The Visual Arts and the Social Sciences in Mid-19th-Century Paris"
WOLF LEPENIES, *Wissenschaftskolleg zu Berlin; Visitor, School of Social Science*

November 7
Social Science Thursday Luncheon Seminar:
"The Rational-Legal State and Human Rights"
NEIL ENGLEHART, *Lafayette College; Member, School of Social Science*

November 11
IAS/Princeton University Economics Workshop:
"Optimal Pricing Mechanisms with Unknown Demand"
ILYA SEGAL, *Stanford University; Member, School of Social Science*

November 14
Social Science Thursday Luncheon Seminar:
"Rejecting Small Gambles Under Expected Utility: A Recent Controversy"
ROBERTO SERRANO, *Brown University; Member, School of Social Science*

November 18
IAS/Princeton University Economics Workshop:
"Optimal Expectations"
MARKUS K. BRUNNERMEIER, *Princeton University* (with Jonathan Parker)

November 21
Social Science Thursday Luncheon Seminar:
"Women, Modernity, and the Uses of History in Early Twentieth Century China"
JOAN JUDGE, *University of California, Santa Barbara; Member, School of Historical Studies*

November 25
IAS/Princeton University Economics Workshop:
"Belief in a Just World and Redistributive Politics"
ROLAND BENABOU, *Princeton University; Member School of Social Science* (with Jean Tirole)

December 2
IAS/Princeton University Economics Workshop:
"The Evolutionary Role of Toughness in Bargaining"
ELLA SEGEV, *Ph D student at Tel Aviv University* (with Aviad Heifetz)

December 5
IAS/Princeton University Economics Workshop:
"Interference"
PATRICK LEGROS, *ECARES, Université Libre de Bruxelles* (with Andrew Newman)

December 11
Corruption Thematic Seminar: "The Politician and the Judge: Accountability in Government"
ERIC S. MASKIN, *Professor, School of Social Science*

December 12
Social Science Thursday Luncheon Seminar:
"Does Globalization Make Inequality Worse?"
ERIC S. MASKIN, *Professor, School of Social Science*

January 15
Corruption Thematic Seminar: "Corruption as a Crime Against the Social Order: The *qadi*-s of Bukhara and the United States House of Representatives"
BABER JOHANSEN, *L'École des Hautes Études en Sciences Sociales; Member, School of Historical Studies*

January 16
Social Science Thursday Luncheon Seminar:
"Pharmaceutical Governance: A Critique of the Brazilian AIDS Model"
JOÃO BIEHL, *Princeton University; Member, School of Social Science*

January 23
Social Science Thursday Luncheon Seminar:
"The Dimensions of Bourdieu Sociology"
LAHOUARI ADDI, *Institut d'Études Politiques; Member, School of Social Science*

January 27
IAS/Princeton University Economics Workshop:
"Online Information Transmission"
ABRAHAM NEYMAN, *Hebrew University of Jerusalem*

January 29
Corruption Thematic Seminar: "Four Syndromes of Corruption"
MICHAEL JOHNSTON, *Colgate University; Member, School of Social Science*

January 30
Social Science Thursday Luncheon Seminar:
"Centripetalism: A Theory of Governance"
JOHN GERRING, *Boston University; Member, School of Social Science*

February 3
IAS/Princeton University Economics Workshop:
"Adaptive Dynamics"
SERGIU HART, *The Hebrew University of Jerusalem*

February 6
Social Science Thursday Luncheon Seminar:
"Working the Border in Ghana: Technologies of Sovereignty and its Others"
BRENDA CHALFIN, *University of Florida; Member, School of Social Science*

February 12
Corruption Thematic Seminar: "Corruption, Coercion, and the Loss of Entitlement Under the People's Commune: Revisiting the Causality of Starvation in Mao's Great Leap Forward Famine, with Special Reference to Qian Fo Village"
RALPH THAXTON, Jr., *Brandeis University; Member, School of Social Science*

February 13
Social Science Thursday Luncheon Seminar:
"Rethinking the 'Social' in Social Science"
WILLIAM SEWELL, *University of Chicago; Member, School of Social Science*

February 20
Social Science Thursday Luncheon Seminar:
"Amartya Sen's Grand Pursuit: Writing About 20th Century Economic Thinkers"
SYLVIA NASAR, *Columbia University; Director's Visitor*

February 26
Corruption Thematic Seminar: Open discussion on the concept of corruption itself, addressed through exploration of issues raised by the distributed readings, and examination of the general themes of the presentations to date
MICHAEL WALZER, *Professor, School of Social Science*

February 27
Social Science Thursday Luncheon Seminar:
"Anti-Corruption Incentives and Strategies in the Post-Communist Region"
RASMA KARKLINS, *University of Illinois, Chicago; Member, School of Social Science*

March 6
Social Science Thursday Luncheon Seminar:
"Reflections of Law and Disorder in Post-Apartheid South Africa"
ADAM ASHFORTH, *Visiting Associate Professor, School of Social Science*

March 10
IAS/Princeton University Economics Workshop:
"Inequality, Growth, and Trade Policy"
ABHIJIT BANERJEE, *Massachusetts Institute of Technology* (with Andrew Newman)

March 12
Corruption Thematic Seminar: "Airport Anthropology: Globalization and the Shifting Frontiers of Customs, Class, and Corruption in Ghana"
BRENDA CHALFIN, *University of Florida; Member, School of Social Science*

March 13
Social Science Thursday Luncheon Seminar:
"Worker Ownership in the U.S.: Contrasting Traditional Corporations and High Tech Knowledge Companies"
JOSEPH BLASI, *Rutgers University; Visitor, School of Social Science*

March 17
IAS/Princeton University Economics Workshop:
"The Measurement of Intellectual Influence"
OSCAR VOLIJ, *Iowa State University*

March 20
Social Science Thursday Luncheon Seminar:
"Bribery and Extortion in the Courtroom"
PHILIP BOND, *Northwestern University; Member, School of Social Science*

March 24
IAS/Princeton University Economics Workshop:
"Inequality, Technology, and the Social Contract"
ROLAND BENABOU, *Princeton University; Member School of Social Science*

March 26
Corruption Thematic Seminar: "Bihar: The Privatization of Violence"
NEIL ENGLEHART, *Lafayette College; Member, School of Social Science*

March 27
Social Science Thursday Luncheon Seminar: "What is It to Wrong Someone? A Puzzle About Justice"
MICHAEL THOMPSON, *University of Pittsburgh; Member, School of Social Science*

March 31
IAS/Princeton University Economics Workshop: "Market Power and Information Revelation in Dynamic Trading"
ROBERTO SERRANO, *Brown University; Member, School of Social Science*

April 3
Social Science Thursday Luncheon Seminar: "The Pleasures of Corruption: Desire and Discipline in Ghanaian Political Culture"
JENNIFER HASTY, *Pacific Lutheran University; Member, School of Social Science*

April 7
IAS/Princeton University Economics Workshop: "The Communication Requirements of Efficient Allocations and Supporting Lindahl Prices"
ILYA SEGAL, *Stanford University; Member, School of Social Science*

April 9
Corruption Thematic Seminar: "Laws and Contracts"
PHILIP BOND, *Northwestern University; Member, School of Social Science*

April 10
Social Science Thursday Luncheon Seminar: "Globalization and Insecurity"
ANDREW NEWMAN, *University College London; Member, School of Social Science*

April 14
IAS/Princeton University Economics Workshop: "Uncertainty, Waiting Costs, and Hyperbolic Discounting"
ERIC S. MASKIN, *Professor, School of Social Science* (with Partha Dasgupta)

April 17
Social Science Thursday Luncheon Seminar: "Antitrust in Dynamic Industries, with Application to the Microsoft Case"
ILYA SEGAL, *Stanford University; Member, School of Social Science*

April 21
IAS/Princeton University Economics Workshop: "Incomplete Information, Credibility, and the Core"
RAJIV VOHRA, *Brown University*

April 23
Corruption Thematic Seminar: "The Circle of Beneficence: Narrating Coherence in a World of Corruption"
LAWRENCE ROSEN, *Princeton University*

April 24
Social Science Thursday Luncheon Seminar: "Belief in a Just World and Redistributive Politics"
ROLAND BENABOU, *Princeton University; Member School of Social Science*

April 28
IAS/Princeton University Economics Workshop: "Contracting in the Presence of Judicial Agency"
PHILIP BOND, *Northwestern University; Member, School of Social Science*

May 1
Social Science Thursday Luncheon Seminar: "Social Policies and State Activism in Brazil"
JOSÉ SERRA, *Universidade de Campinas, São Paulo, Brazil; Director's Visitor*

May 7
Corruption Thematic Seminar: Open discussion of issues raised throughout the year

May 8
Social Science Thursday Luncheon Seminar: "What Does Not Kill You Makes You Stronger? The Case of Arsenic in Drinking Water in Bangladesh"
MALGOSIA MADAJEWICZ, *Columbia University; Visitor, School of Social Science*

May 15
Social Science Thursday Luncheon Seminar: "Which Way to Mecca? Remarks on Some Recent American Books on Islam"
CLIFFORD GEERTZ, *Professor Emeritus, School of Social Science*

May 21
Summer Seminar on Corruption: "Four Corruption Syndromes: Case Studies"
MICHAEL JOHNSTON, *Colgate University; Member, School of Social Science*

May 28
Summer Seminar on Corruption: "Restraining or Radicalizing? Division of Labor and Persecution Effectiveness" and "A Market for Mass Crime? Inter-institutional Competition and the Initiation of the Holocaust in France, 1940-1942"
WOLFGANG SEIBEL, *University of Konstanz; Member, School of Historical Studies*

June 4
Summer Seminar on Corruption: "Intellectuals and Democratization, 1905-1912 and 1989-1996"
CHARLES KURZMAN, *University of North Carolina, Chapel Hill; Member, School of Historical Studies*

June 11
Summer Seminar on Corruption: "Somalia: Rising from the Ashes?"
NEIL ENGLEHART, *Lafayette College; Member, School of Social Science*

June 16
IAS/Princeton University Economics Workshop: "Bargaining, Coalitions, and Externalities"
ERIC S. MASKIN, *Professor, School of Social Science*

June 18
Summer Seminar on Corruption: "Working the Border/Navigating Sovereignty: Ghana's Customs Service"
BRENDA CHALFIN, *University of Florida; Member, School of Social Science*

June 25
Summer Seminar on Corruption: "Modernity and Divided Mankind: Notes on a Constitutional Culture"
MATEO TAUSSIG-RUBBO, *University of Chicago; Visitor, School of Social Science*

July 2
Summer Seminar on Corruption: "The Press and Political Culture in Ghana"
JENNIFER HASTY, *Pacific Lutheran University; Member, School of Social Science*

July 16
Summer Seminar on Corruption: "Beyond Gift and Commodity: The Economy of the Sacred in Jewish Law"
MADELINE KOCHEN, *Harvard Law School; Research Assistant, School of Social Science*

"*During this year, I have also devoted a large part of my time to educating myself and learning new things ... the Institute is a great place to be since it allows one to expand scientific horizons so easily. I am eagerly using this opportunity by attending various seminars and workshops, and interacting with other Members.*"

—Member, School of Natural Sciences

Afternoon tea in the Common Room, Fuld Hall

PROGRAM IN INTERDISCIPLINARY STUDIES

Faculty
PIET HUT

PIET HUT established a new interdisciplinary program. His visitors spanned the fields of physics and astrophysics, computational biology, computer science, cognitive science, and philosophy.

Professor Hut's own research focused on astrophysics. Together with colleagues from Japan and Holland, he published results from the first realistic N-body simulations of globular clusters, modeling the galactic cluster M15 and the giant cluster G1 in M32. He published several other papers in stellar dynamics, on the long-term evolution of isolated N-body systems, on the details of core collapse, as well as on other topics.

He published a book, *The Gravitational Million-Body Problem*, coauthored with Douglas Heggie of Edinburgh University. He organized a second workshop in the MODEST series (for MOdeling DEnse STellar systems), which he had started the year before, when he organized MODEST-1 in New York City. MODEST-2 was held in Amsterdam, in December 2002, with co-organizer Simon Portegies Zwart of Amsterdam University.

Together with Apollo astronaut Russell Schweickart, Professor Hut organized a workshop on Deflecting Asteroids, at the NASA Johnson Space Center in Houston, Texas. This was a follow-up meeting of a conference he organized there in 2001 with astronaut Ed Lu. He was also one of the organizers of a conference and summer school on the topic of "Ways of Knowing," at Amherst College, as the fifth public offering of the Kira Institute, of which he is one of the founding members.

The program welcomed the following visitors during the course of the year:

Yoko Funato, Astrophysics, University of Tokyo
Douglas Heggie, Astrophysics, University of Edinburgh
Jun Makino, Astrophysics, Tokyo University
Steve McMillan, Astrophysics, Drexel University
Steven Tainer, Asian Philosophy, Institute for World Religions

PROGRAM IN THEORETICAL BIOLOGY

Martin A. Nowak, Head

Martin Nowak completed his fifth year as Head of the Program in Theoretical Biology at the Institute for Advanced Study. The research interests of Nowak's group included the dynamics of infectious diseases, evolutionary genomics, genetic instability and tumor progression, evolution of language, and evolutionary theory in general. The group included three Members, Yoh Iwasa (Kyushu University), Natalia Komarova, and Alun Lloyd; one Visitor, Steve Frank (University of California, Irvine); and three Ph.D. students, Franziska Michor, Garrett Mitchener, and Joshua Plotkin. Research reports are included below.

Martin Nowak worked on mathematical models of cancer genetics. In collaboration with experimental groups led by Bert Vogelstein and Christoph Lengauer, he developed a theory for the initiation of colon cancer and the role of chromosomal instability. With Yoh Iwasa, Natalia Komarova, and Franziska Michor, he worked on a precise quantification for the somatic devolution of tumor suppressor genes. He invented the 'Linear process,' a stochastic description of evolutionary dynamics in multi-cellular organisms including cellular differentiation. With Iwasa and Michor, Nowak developed a general theory for escape dynamics from lethal selection pressure. This theory describes, for example, emergence of resistance of microbes or cancer cells to drug treatment and vaccination.

With experimentalists George Shaw and Persephone Borrow, Nowak quantified the role of neutralizing antibodies and cytotoxic T cells in primary HIV infection defining 'co-dominance' of immunological responses.

With Partha Niyogi and Erez Lieberman, Nowak is working on a review of learning theory in the context of language acquisition introducing cooperative teachers and ambitious learners.

Nowak received the Henry Dale Prize of the Royal Institution of London. He gave the David Starr Jordan Prize Lecture at Cornell University.

In July 2003, Martin Nowak moved to Harvard University as Professor of Mathematics and of Biology, and founding Director of Harvard's new Institute for Theoretical Biology.

Yoh Iwasa worked on the somatic evolution of cancer, and mathematical formulas for transition rates. To estimate the risk of cancer, stochastic modeling of somatic evolution is very effective. In collaboration with Martin Nowak, Steve Frank, and Franziska Michor, Iwasa has been working on the importance of chromosomal instability (or genomic instability) or tissue structures, such as compartmentalization or the division to the stem cells and differentiated cells. In all of these, Iwasa played a role of deriving formulas that needed to analyze mathematical models used in these theoretical works. First, Iwasa developed a method estimating the risk of escape via a chain of mutations leading to cancer cells, in which the intermediate states are of fitness lower than the normal cells. Second, he examined the mathematical formula for the fixation of the second step mutants without fixation of the first step mutants, named "tunneling."

Iwasa also worked on escape probability, and the host's optimal immune response. He and others in the group discussed the optimal immune response to a community of viral strains including multiple viral strains with different epitomes deleted. Iwasa proved that the optimal host response is the mini-max solution, and could solve so the very clear pattern as the optimal response of the host.

Natalia Komarova's research was mostly concerned with three topics: modeling of cancer, virus dynamics in immunosuppressive infections, and the physics of DNA transcription. In modeling of cancer, Komarova sought to describe cancer initiation and progression by using methods of population dynamics. The focus of this research is to understand the role of chromosomal instability in tumors. Insights were obtained for how tissue is organized to be best protected against cancer; the results can also be beneficial for designing methods of treatment since it sheds light on how chemotherapy may work. The second direction of research is concerned with modeling how anti-drug therapy can boost the immunity in immunosuppressive diseases like HIV or Hepatitis C. An interesting relationship between the timing of the therapy, its efficacy and success has been found. Finally, Komarova worked on a mathematical description of biological double membranes. A new equation has been proposed that supports a stable, pinned soliton-like solution. This can explain the details of the process of DNA transcription.

Alun Lloyd's research addresses various issues regarding infectious diseases. Lloyd's main ongoing project involves a study of the historical record of childhood disease incidence in the United States. Spatial structure is of particular interest and Lloyd has been developing models that relate frequency of travel between major cities and patterns of disease spread. In other projects, Lloyd has been considering infections which consist of a collection of related 'strains;' examples of such diseases include the common cold, influenza and HIV. Since treatment, or vaccination, is unlikely to be equally effective against all strains, any attempt to understand the impact of treatment must consider this strain structure.

Much of this work is very topical, given the increased concern regarding bioterrorism, the spread of drug resistance, and emerging infectious diseases such as SARS. As a result, during the last year Lloyd has been very actively involved in promoting the wider use of mathematical techniques to address such questions. This effort has included presentations at both the NIH and NSF, organizing an international conference that discussed spatial aspects of epidemiology, as well as being a coauthor on a major review project for a U.S. Homeland Defense Agency. In addition, Lloyd works with pharmaceutical companies in developing mathematical models to better understand the consequences of the deployment of novel antiviral drug therapies.

Garrett Mitchener's research has focused on exploring population-level dynamics of languages, following the language dynamical equation, a model being studied by Martin Nowak and others in the Program in Theoretical Biology. Mitchener has been working on an extension of that model which allows for multiple universal grammars. (Universal grammar, or UG for short, is the set of innate constraints that determine what grammars a human being can acquire.) They are primarily interested in the outcome of competition between two universal grammars: whether one of them can take over the population, and whether more than one can coexist stably. They have finalized several results for

various cases of this extended model that show competitive exclusion and coexistence, and a paper about them was published in January in the *Bulletin of Mathematical Biology*.

Joshua Plotkin has continued to research the stability and adaptability of cellular and viral populations. In particular, Plotkin and collaborators at Princeton University have been studying the genomic evolution of the Influenza A virus. Using a large empirical dataset of viral RNA sequences, Plotkin has introduced a new method for predicting future dominant influenza amino acid sequences and studied its relevance to improving annual vaccine choice. Plotkin has also introduced novel methods, based upon the idea of codon usage bias, to detect genes that are undergoing active selection in viruses and other organisms. Aside from applications to influenza, Plotkin has worked to detect genes under strong selection in the SARS-related coronavirus, helping to identify the gene(s) responsible for the current outbreak in humans.

Arnold J. Levine, Visiting Professor
School of Natural Sciences

In Arnold Levine's first year as Visiting Professor in the School of Natural Sciences and the Program in Theoretical Biology, he worked with a group whose research interests include genetics and genomics, polymorphisms and molecular aspects of evolution, signal transduction pathways and networks, stress responses and pharmacogenomics in cancer biology. The group explored the linkage between theoretical and experimental biology and included two Members, Harlan Robins, a postdoctoral fellow trained in physics at the University of California, Berkeley, and Babu Venkataraghavan, a structural chemist and computer scientist who has been in the pharmaceutical industry for 35 years. The group also includes a Visitor, Gyan Bhanot, who is a physicist and computer scientist who works at IBM on biological problems. In addition to this group, the 2003-04 academic year will bring Dr. Michael Krasnitz, a physicist trained at Princeton University who will be a member and postdoctoral fellow, and Dr. Gabriela Alexe trained at Rutgers University as a mathematician and statistician who will also be a member and postdoctoral fellow. Thus, the Program in Theoretical Biology has a critical mass at the Institute, and has a well-developed plan to interact with the Genome Center at Princeton University and the BioMaPS group at Rutgers University. A variety of joint "lab meetings," seminars, symposia and public lectures are planned for the next academic year.

During the past year, the group explored the information held in several large data sets produced by the biological community. The large DNA sequence databases were probed to define and identify the nucleic acid sequences that regulate the transcription of a gene in space, time and amount in an organism or cells. Here DNA chip analysis carried out in the laboratory provided the information that was matched to the patterns of sequences found to be in and near a gene. Second, there has been an extensive exploration of codon uses in genes as a function of the place, time, and amount of a gene product produced. Conservation of codon uses during evolution in orthologs and homologs were explored. The extensive single nucleotide polymorphism (SNP) database was examined for a set of genes in specific signal transduction pathways that are important in the origins and evolution of cancers in humans. Here the information obtained for interesting asymmetries in the occurrence of SNPs in genes and their impact upon cancer incidence was transferred to experimental testing in the laboratory.

Arnold Levine's research focused upon two areas. The first was a theoretical and experimental study of the different types of "noise" that impacts upon biological signal transduction pathways that transmit information from the environment to inside a cell and have the cell respond to the signal. The second avenue of research led to the development of a useful algorithm to detect transcription factor protein binding sites on the DNA that regulate gene expression. The procedure developed a rapid scan of the entire genome (human or mouse) to select the p53 protein responsive elements (RE) that regulate cellular responses to environmental insults.

1. Noise signal transduction pathways.

A simple signaling pathway was created in the bacterium *E. coli* where the exact same regulatory elements were placed adjacent to a gene for green fluorescent protein or red fluorescent protein. Each of these two genes was then inserted into the *E. coli* chromosome in similar locations on either side of the origin of replication. Because the two genes are regulated by identical DNA sequences (promoters), it would be expected that both proteins would be made in identical amounts and each bacterium would have a yellow (red and green are equal) fluorescent color. If noise were introduced into the signaling pathway of one gene, then more red or more green protein would be made, and by examining single cells over time (in a movie) the percentage of red or green cells can be employed to quantitate the noise. Employing this assay several conclusions can be obtained. There are at least two kinds of noise; extrinsic noise comes from thermal, ionic or environmental sources, while the intrinsic noise comes from rate limiting components of the pathway or asymmetric segregation of components in the pathway. Second, different genetic backgrounds of the bacteria alter the percentage of cells exhibiting noise and specific genes in a cell can regulate the level of noise. Thus, organisms can optimize noise in a pathway via mutation and evolution can select a level of noise that is optimal. Some noisy signaling pathways could use that property to produce offspring that are genetically identical but differ in their phenotype. The quantitative data obtained in this experimental study fit the results of a mathematical theory of intrinsic and extrinsic noise in this system.

2. Scanning the genome for transcriptional signals.

a. An algorithm has been designed that can rapidly scan over three billion bases in nucleotide sequences (a genome) and pick out a sequence that a transcription factor can bind to so as to regulate a specific gene. Because the nucleic acid sequence that the protein binds to (RE) can vary or be degenerate in selected positions or sites in the sequence, both a filter that requires that certain positions be fixed in a sequence and a weight matrix that provides a score for preferred bases in certain positions of the sequence were employed in the algorithm. The algorithm was employed to select 16 genes from the human and mouse genome that were predicted to be regulated by the p53 transcription factor and had never before been identified in the literature. To date, 12 out of the 16 genes have been experimentally shown to be regulated by this transcription factor and the remaining four genes are still under investigation.

b. The sequence in the DNA that is recognized by the p53 protein is an imperfect ten base pair palindrome whose sequence is repeated once more, and these repeats are separated by a spacer of any sequence. Commonly, most genes that are regulated by p53 protein have spacer lengths of zero to twenty-one bases. A scan of the genome for p53 spacer

lengths has surprisingly detected about 400 copies of genes with 129 base pair spacers, and 500 genes with 1,065 and 3,095 base pair spacers. In both cases, these p53 REs with these unusual spacer elements are found in repetitive DNA sequences in our genome and have been identified as an endogenous human retrovirus (called HERV K) with the 129 base pair repeats and 500 retro-transposon LINE-1 elements with the p53 REs separated by larger spacers. These are parasites in our genome and it is surprising that they have adopted a cellular transcription signal that responds to stress (DNA damage, hypoxia, etc.). Having identified these DNA elements in the genome data set, experiments in the laboratory were employed to determine if these parasites were transcribed or regulated by p53 signals. Indeed, the HERV-H retrovirus is transcribed in response to p53 activity in cells with a twelve-fold increase in HERV-H m-RNA. The LINE-1 elements with the p53 RE sequences have been shown to be active LINE-1 transposons that move about the genome and cause mutations in each generation of humans. Studies are underway in the laboratory to determine if these p53 REs are functional and activate or repress the movement of the LINE-1 transposon.

Publications related to this progress report:

1. Elowitz, M.B., Levine, A.J., Siggia, E.D., Swain, P.S. 2002. Stochastic Gene Expression in a Single Cell. *Science*, 297:1183-1186.
2. Hoh, J. Jin, S., Parrado, T., Edington, J., Levine, A.J., Ott, J., 2002, The p53 MA Algorithm and its Application in Detecting p53 Responsive Genes. *Proceedings Nat. Acad. Sci., USA*, 99: 8467-8472.

Additional Publications:

1. Su, F., Overholtzer, M., Besser, D. Levine, A.J. 2002. WISP-1 attenuates p53-Mediated apoptosis in response to DNA damage through activation of the Akt Kinase. *Genes and Development*, 16:46-57.
2. Pugacheva, E.N. Ivanov, A.V., Kravchevenko, J.E., Kopnin, B.P., Levine, A.J., Chernakov, P.M. 2002. Novel Gain of Function Activity of p53 Mutants: Activation of the dUTPase Gene Expression Leading to Resistance to 5- fluorouracil. *Oncogene*, 21:4595-4600.
3. Singh, B., Reddy, P.G., Goberdhan, A., Walsh, C., Dao, S., Nagai, I., Chou, J.C., O'Chavenat, C., Levine, A.J., Rao, P.H., Stouffel, A., 2002, P53 Regulates Cell Survival by Inhibiting PIK3CA in Squamous Cell Carcinomas, *Genes and Develop.* 16:984-993.
4. Levine, A.J., 2002, The Origins of Cancer and the Human Genome, *The Genomic Revolution Unveiling the Unity of Life*, ed. M. Yudell and R. DeSalle, Joseph Henry Press: 87-96.
5. Jin, S., Kalkum, M., Overholtzer, M., Stoffel, A., Chait, B.T., and Levine, A.J., CIAP1 and the erine protease HTRA2 are involved in a novel p53-dependent apoptosis pathway in mammals. *Genes and Development*, 17:359-367.

Harlan Robins is working on three projects exploring different aspects of regulation in biological networks. His first project is a search for micro RNA targets. These micro RNAs are short (about 80 bp) RNA molecules that are cut by a protein complex into a ~22bp single stranded RNA. They then bind to various target mRNAs and prevent translation. Targets have been found in the worm and the fly where micro RNAs control developmental timing. Robins is writing an algorithm to find their targets in vertebrates (including humans).

The next project Robins is working on is the control mechanism of tRNA abundance on translation rate. Joshua Plotkin, Arnold Levine, and Harlan Robins are exploring codon usage in different cell types in humans. They have found evidence that certain cell types have very different percentages of most codons. The hypothesis is that the cell uses these differences to up or down regulate production of certain proteins in different cells. In a third project completed earlier this year, Robins looked at some global properties of these networks. The present opinion among biologists is that having a robust network makes it harder for an organism to evolve. The organism is supposed to find a balance between robustness and evolutionary speed. Robins made a mathematical argument that robustness can actually increase the speed of evolution.

The Program in Theoretical Biology Lecture Series
Each year, distinguished scientists in diverse areas of biology are invited to give a public lecture at the Institute. The following lecture was presented during the 2002-03 academic year:

February 24 — "Science, Anxiety, and Meaning: Biomedicine Encounters Ethics and Public Policy"
Harold T. Shapiro, *Princeton University*

Biology Group Meetings
Arnold Levine initiated a series of regular meetings for people interested in research in biology. Meetings consisted of presentations and discussion, and were held in the Physics Library in Bloomberg Hall.

October 9 — "p53 Pathway"
Arnold Levine, *Institute for Advanced Study*

November 5 — "Immortality"
Arnold Levine, *Institute for Advanced Study*

November 18 — "Responding to Stress"
Arnold Levine, *Institute for Advanced Study*

December 3 — "The Limits to Immortality Are in Our Chromosomes"
Arnold Levine, *Institute for Advanced Study*

December 17 — "The Human Genome Project"
Arnold Levine, *Institute for Advanced Study*

January 9 — "Dynamics of Cancer Initiation"
Martin Nowak, *Institute for Advanced Study*

January 23 — "In the Language of the Epistasis:
Detecting SNP-SNP and Protein-DNA Interactions"
Josephine Hoh, *Rockefeller University*

February 13 — "Aspects of the Ecology and Evolution of Influenza Virus"
Joshua Plotkin, *Institute for Advanced Study*

February 25 — "The Disk-Covering Method for Phylogenetic Tree Reconstruction"
Tandy Warnow, *University of Texas at Austin*

March 13 "Regulatory Modules in Drosophila Development"
Massimo Vergassola, *Institute for Advanced Study*

April 24 "Genetic Instability in Cancer Progression"
Natalia Komarova, *Institute for Advanced Study*

May 8 "Modeling the Structure Space of Proteins"
Babu Venkataraghavan, *Wyeth-Lederle Vaccines & Pediatrics*

May 23 "Identification of Collective Biomarkers by Logical Analysis of Data"
Gabriela Alexe, *Rutgers University, Center for Operations Research*

June 9 "Single Nucleotide Polymorphism in the MDM-2 Gene"
Gareth Bond, *The Cancer Institute of New Jersey*

Institute for Advanced Study/Princeton University Biology Group Meeting
The following talks were presented during a biology group meeting December 9, 2002, in the Physics Library of Bloomberg Hall:

"The pp28 Tegument Protein of Human Cytomegalovirus Functions in the Final Envelopment of Virions"
Maria da Silva, *Princeton University*

"A Bio-Dictionary-Based Annotation of Human Cytomegalovirus"
Eain Murphy, *Princeton University*

"A Novel p53 Dependent Apoptotic Pathway and a Potential Novel Tumor Suppressor Gene"
Shenkan Jin, *The Rockefeller University*

"Regulation of p53 Activity via the C Terminal Region"
Stu Lutzker, *The Cancer Institute of New Jersey*

"A Continuing Exploration of How the Human Cytomegalovirus pp71 Protein Utilizes Both the Ubiquitin-proteasome and Rb-E2F Pathways to Modulate Cell Cycle Progression"
Robert Kalejta, *Princeton University*

"Inhibition of p53 Transcription by a Well-Defined Tumor-Promoting Agent"
Jill Bargonetti, *Hunter College*

"Noise in Gene Expression"
Mike Elowitz, *The Rockefeller University*

"Genetics and Biology of Extranodal B-Cell Lymphomas"
Toula Stoffel, *The Rockefeller University*

"p53 MDM-2 Interaction Inhibition"
Wei Liu/Dan Notterman, *The Cancer Institute of New Jersey*

ARTIST-IN-RESIDENCE PROGRAM

Jon Magnussen, Composer

During the 2000-01 season, Jon Magnussen planned his first year of Institute for Advanced Study concerts (2001-02 season), and developed the Institute Artist-in-Residence Program's website (www.ias.edu/artist-in-residence). Magnussen conducted his chamber music *Altered Path* (1994) in November with the Composer's Ensemble at Princeton University's Taplin Auditorium. He arranged a suite of his ballet *The W'inged* (1996) for performances in May with the Orchestra of St. Lukes conducted by Judith Clurman, with the José Limón Company at the Sylvia and Danny Kaye Playhouse in New York City. In late June, Magnussen finished *Toccare!*, a commissioned work for solo piano (the first work started and finished at the Institute for Advanced Study), which was premiered in Walden, New Hampshire, in late July by the commissioner, pianist Blair McMillen. Magnussen composed *Ko'olau Sketches* in July, a work he created with a view to developing musical ideas for a new opera based upon W.S. Merwin's *The Folding Cliffs*.

During the 2001-02 season, the New York Percussion Quartet gave the world premiere performance of Magnussen's *Ko'olau Sketches* (2001) in October at Wolfensohn Hall. Pianist and composer Noël Lee gave the Princeton premiere of *Toccare!* in December in Wolfensohn Hall, and in November, Magnussen composed *Psalm 21* for baritone Sanford Sylvan and pianist David Breitman. In mid-January, Magnussen finished *Psalm*, a 30-minute ballet score commissioned by the José Limón Foundation with funding from the Library of Congress and Meet the Composer. In late January, he produced the recording of *Psalm* (in which he played tambourine), performed by the Riverside Chamber Singers and Members of the Riverside Philharmonic Orchestra with André Solomon-Glover, baritone and Helen Cha-Pyo, conductor. In February, Magnussen conducted members of the Weber State Concert Choir, the Kay Starr Singers and chamber ensemble with André Solomon-Glover, baritone soloist, in the world premiere performance of *Psalm* at the 2002 Salt Lake Winter Olympic Arts Festival. In April 2002, he composed *Fantasy Rewired* for Mari Kimura, scored for amplified violin and tape. The work was premiered by Kimura on May 11 in the Birch Garden at the Institute, where she also performed the work from which *Fantasy Rewired* was derived: *Fantasy for Violin and Synthesizers*.

The 2002-03 season saw more work in the orchestral domain, and also a return to an opera project first conceived in 2000-01. In August 2003, Magnussen began communications with author Gavan Daws about an opera (working title: *The Folding Cliffs)* based upon a true 19th-century story about a Hawaiian man who contracts leprosy and resists forced separation (by the Provisional government army) from his wife and child. This work is ongoing. Also in August, Magnussen composed *Occhi dolente* (a vocal octet), for conductor/tenor Andrew Megill and *Fuma Sacra*. This work was premiered in October 2003 in Wolfensohn Hall. On November 3, 2002, his first Carnegie Hall performance took place with the New York premiere of excerpts of *Psalm* (with expanded string and choral forces), by the American Composers Orchestra and conductor Steven Sloane. In January, Magnussen composed *Kaleimanu's Dream*, a six-minute work for guitarist Antigoni Goni. In February, baritone Sanford Sylvan and pianist David Breitman gave the world premiere of *Psalm 21*, which Magnussen composed for them in the fall of 2001. On April 26, 2003, Magnussen's new *Scenes*, for large orchestra, was premiered by conductor Paul Polivnick with the Symphony San Jose Silicon Valley. The work was commissioned for the symphony's inaugural season. In May, Magnussen began orchestrating chamber works by

Chausson, Chopin and Schumann for a 55-minute ballet choreographed by Robert Hill based upon "The Picture of Dorian Gray." The orchestration was commissioned by American Ballet Theatre, for which he will conduct the ABT orchestra in the premiere performances at their City Center (New York) season in 2003. Also in May, Magnussen continued work with Daws on *The Folding Cliffs*, and in June, he revised the score for *Psalm*.

DIRECTOR'S VISITORS

GEORGE DYSON

SYLVIA NASAR

Scholars from a variety of fields, including areas not represented in the schools, Director's Visitors contribute much to the vitality of the Institute. They are invited to the Institute for varying periods of time, depending upon the nature of their work.

INSTITUTE FOR ADVANCED STUDY/ PARK CITY MATHEMATICS INSTITUTE

The IAS/Park City Mathematics Institute (PCMI) is an integrated mathematics program that has been sponsored by the Institute for Advanced Study since 1994. Participants in PCMI include research mathematicians, graduate students, undergraduate students, mathematics education researchers, undergraduate faculty, and high school teachers. The interaction among these diverse groups fosters a stronger sense of the mathematical enterprise as a whole. In addition, it raises awareness of the roles of professionals in the mathematics-based professions.

The annual three-week Summer Session is the flagship activity of PCMI. Additional programs take place throughout the year and include the year-long High School Teacher Program and the Lecture Publication Series.

Summer Session
The 13th annual Summer Session of the IAS/Park City Mathematics Institute (PCMI) was held June 29-July 19, 2003 in Park City, Utah. This year's PCMI Summer Session, with a total of 260 participants, included the following programs:

Research Program in mathematics
Graduate Summer School
Undergraduate Summer Program
High School Teacher Program
Undergraduate Faculty Program
Mathematics Education Research Program
International Seminar on Mathematics Education

As is the case each year, a specific area of mathematics was chosen to provide the focus for the overall programming. The mathematical topic for the 2003 Summer Session was *Harmonic Analysis and Partial Differential Equations*, and this topic informed the work of the Graduate Summer School, the Research Program and the Undergraduate Program.

The related mathematical topic in the Undergraduate Faculty Program was *Partial Differential Equations*. The Mathematics Education topic for 2003 was *Knowledge of Mathematics for Teaching*, while *Sums and Differences: The Art and Craft of Adding and Subtracting* was the topic of the mathematics course offered in the High School Teachers Program.

Each of the programs met daily for its own series of courses and seminars. The groups also came together for an afternoon Cross Program Activity two or three days per week. A complete listing of courses, seminars and activities follows.

Graduate Summer School and Research Program
Organized by Michael Christ, University of California at Berkeley, Carlos Kenig, University of Chicago, and Wilhelm Schlag, California Institute of Technology, the Graduate Summer School met for three formal lectures and one or two problem sessions each day.

At the heart of the Graduate Summer School were six main graduate courses, two each week. Each of these courses consisted of five or six lectures, except for one series of four. One course focused on a circle of problems in core Fourier analysis, two were concerned with questions on nonlinear partial differential equations in which techniques rooted in harmonic analysis play essential roles, and three were expositions of topics at the interface between harmonic analysis and other aspects of mathematics.

In addition to the six main courses, the Graduate Summer School also included two courses at a more introductory level. The first, by Wilhelm Schlag, was an introduction to basic Fourier analysis, with the goal of bringing participants up to speed on some of the material used in the main six courses. It consisted of four lectures given during the first week of the institute, supplemented by a 100-page text that will appear in the proceedings volume. This course also attracted several of the more advanced undergraduate students. The second, by Michael Christ, consisted of three lectures at the end of the second and beginning of the third weeks, and was intended to serve as a quick introduction to some of the material discussed by Elias M. Stein, in particular to aspects of the Heisenberg groups and singular integral operators.

There were problem sessions associated with all of the graduate courses. Three hours of problem sessions were offered during most days of the first two weeks of the institute, with two hours during the third.

Graduate Summer School lecturers and course titles:
Introductory lectures to Harmonic Analysis (four lectures); Wilhelm Schlag, California Institute of Technology
Nonlinear Fourier Transforms and Scattering (six lectures); Christoph Thiele, University of California, Los Angeles
Uniform Rectifiability and Applications (four lectures); Guy David, Université de Paris Sud, Orsay
Kakeya-type problems, restriction conjectures, and local smoothing estimates (six lectures); Terence Tao, University of California, Los Angeles
Global well-posedness for dispersive equations and the method of almost conservation laws (five lectures); Gigliola Staffilani, Massachusetts Institute of Technology
Introduction to the Heisenberg Group and Szego Projection (three lectures); Michael Christ, University of California, Berkeley

Singular Integrals and Several Complex Variables (five lectures); Elias Stein, Princeton University
Harmonic Analysis and its applications to non-linear evolution equations (six lectures); Carlos Kenig, University of Chicago
The Hardy-Littlewood Circle Method (one lecture); Stephen Wainger, University of Wisconsin, Madison

The Research Program
The Research Program attracted about 50 participants, who attended for periods ranging from three weeks to a few days. This program's main formal activities were seminars, usually two per day during the first two weeks, and one per day during the third week. The graduate courses were also attended by large numbers of research program participants, who enjoyed these high quality, accessible presentations of topics outside their own areas of specialization. Indeed, the organizers found that a substantial number of researchers declined invitations to lecture, preferring to concentrate on behind-the-scenes conversations and on attending the graduate courses. Research talks were usually attended by several graduate students, as well.

There was ample opportunity for less formal interaction in the Research Program. Blackboards in the hallway of the conference center facilitated impromptu conversations, and various seminar rooms with tables and blackboards were available during parts of the day and evenings.

Research Program Seminars:
On Restriction of the Fourier Transform; G. Mockenhaupt
Solutions, Spectra, and Dynamics for Schroedinger operators; A. Kiselev
Subharmonic functions associated with stationary Schroedinger operators; A. Kheyfits
Some questions related to the Carleson-Hunt Theorem; C. Muscalu
1D Schroedinger: Heuristics and Theorems; R. Killip
Regularity of Degenerate Monge-Ampere Equations; C. Rios
Blowup for L^2 – critical nonlinear Schroedinger Equation; P. Raphael
Big pieces of "regular manifolds" in measures and data sets; G. Lerman
Recent progress on the vector field problem; X. Li
L^p Carleman estimates and uniqueness of solutions and semilinear Schroedinger equations; A. Ionescu
Distance sets and applications; A. Iosevich
Bellman functions and continuous problems; S. Petermichl
Dispersive estimates for the Schroedinger equation in Dimension 3; M. Goldberg
On uniqueness for wave equations; F. Planchon
Self-similar solutions of binormal flow; L. Vega
Two model operators with fold singularities and related maximal functions; A. Seeger
On Schroedinger and wave maps at critical regularity; A. Nahmod
Variational and jump inequalities in harmonica analysis; J. Wright
Estimates in the Corona theorem and ideals of H^∞: a problem of T. Wolff; S. Treil
Spectral multipliers for the Laplace-Beltrami operator on forms on the Heisenberg group; F. Ricci
Geometric questions related to Sobolev embedding; W. Beckner

The High School Teacher Program
Twenty eight middle school and high school teachers spent a rewarding and challenging three weeks learning mathematics, reflecting on what it means to teach mathematics, and working together to produce materials that could be shared with their colleagues both at PCMI and more broadly through the PCMI website. Ten teachers were returning for a second year, and three teachers were chosen for a third year to work with the staff as leaders and advisers for the other participants; there were also fourteen first-time participants. The participants came from thirteen states and Canada, and included a teacher who had retired and started teaching again in a new district and one who had been teaching for only one year. The teachers represented PDO groups based in Los Angeles, Seattle, New Jersey, and Cincinnati, as well as those who came as individuals.

The mathematics session, *Sums and Differences: the Art and Craft of Adding and Subtracting*, focused on an analysis of finite differences using materials created by the Educational Development Center. Under the leadership of two master teachers from the PROMYS program at Boston University, PCMI participants explored how concepts dealing with sums of powers, Fibonacci numbers, and complex numbers are related under the concept of difference equations.

The participants worked mathematics problems together and compared strategies, discussed student work, and researched topics related to the teaching and learning of mathematics. Also, the question, "Is a teacher a mathematician?," as posed by Judith Ramaley, Assistant Director for the Education and Human Resources (EHR) Directorate at the National Science Foundation, in a video-taped talk, invited spirited discussion between mathematicians and teachers and laid the foundation for the teachers' conference work. Added to the experience was a special discussion session with Deborah Ball of the University of Michigan regarding a cross program presentation on her teaching laboratory with fifth grade students (part of the Mathematics Education Research Program at PCMI).

For two hours each afternoon, participants participated in one of four working groups - data analysis, geometry, lesson study, and mathematics/physics related to the morning work. During this time they produced lessons, classroom activities, and drafts of potential articles on interesting and useful mathematics that will be tested in their classrooms when appropriate, reviewed during the coming year, revised when necessary, and posted on the PCMI website at the Math Forum.

Math Supervisors Workshop
Since the program's inception, PCMI has concentrated on preparing high-school teacher-leaders to design and present professional development activities to their colleagues at the local level. A new stage in this process was begun in the summer of 2002 and continued in 2003; PCMI is now partnering with selected school districts on designing methods by which the PCMI professional development model can become part of the district's official in-service activities.

During the 2003 PCMI Summer Session, mathematics supervisors from six school districts, together with university mathematicians from their regions, met with High School Teacher Program leaders Gail Burrill and Kimya Moyo to plan the implementation of that transfer in three pilot districts: Cincinnati Public Schools, the McAllen (Texas) Independent School District, and Seattle Public Schools. With appropriate funding, it is

anticipated that these three districts will be the focus of PCMI's 'transfer' project during the next three years. The basis of the project will be the strategy and timetable laid out jointly in the Summer 2003 workshop by PCMI leadership and district personnel, with support from university mathematicians.

Undergraduate Program
The Undergraduate Program for 2003 was organized by Roger Howe, Yale University, and William Barker, Bowdoin College. The undergraduate program was focused on two courses, an introductory course designed for students having just completed calculus and linear algebra, and an advanced course for students with a more extensive mathematical background. This year, the introductory course, *Fourier Analysis and its many uses*, was offered by Thomas Körner of Cambridge University, and the advanced course, *Introduction to Wavelets*, was offered by Lesley Ward of Harvey Mudd College.

Both courses were full of conceptual insights and carefully developed technical results. Other activities at PCMI attracted a significant number of undergraduates and enriched the undergraduate program: the Undergraduate Faculty Program offered an introductory course on *Partial Differential Equations* and the High School Teachers Program offered a discovery-style session on topics in number theory. This latter course was especially valuable for those undergraduates with only introductory preparation; more advanced undergraduate students selected and attended courses from the Graduate Summer School.

This year the daily PCMI schedule was designed to minimize conflicts between offerings of interest to the undergraduates. The result was a high degree of flexibility for the undergraduates, permitting students to put together the combination of sessions which best suited their individual backgrounds and interests

Undergraduate Faculty Program
The Undergraduate Faculty Program (UFP) at PCMI 2003, entitled *Harmonic Analysis and Partial Differential Equations in the Undergraduate Curriculum*, was designed for faculty members who primarily teach undergraduates, such as those at two and four year colleges. This year Andrew Bernoff of Harvey Mudd College facilitated the Undergraduate Faculty Program. The program's goal was two-fold: the first was to improve the participants' facility with teaching partial differential equations in the undergraduate curriculum with an emphasis on using technology; the second was to outline a program by which students can be acquainted with the tools and trade of being a research mathematician. There were twelve participants in the 2004 Undergraduate Faculty Program.

A secondary goal of this program was to interact with the other PCMI participants by presenting a variety of seminars that were of interest to the broader PCMI community. The UFP participants presented a series of fourteen lectures (with associated labs and problem sessions) that constituted an introductory course on *Partial Differential Equations*, emphasizing harmonic analysis, Fourier methods, and eigenfunction expansions. These lectures tended to attract fifteen to twenty of the undergraduate students at PCMI in addition to the UFP participants.

Also presented were two Problem Solving Seminars, which attracted an average of fifteen undergraduates and twenty High School teachers as well as participants of the Undergraduate Faculty Program.

Mathematics Education Research Program
The Mathematics Education Program consisted of two short seminars in 2003.

Begun in 2001, the annual PCMI International Seminar on Mathematics Education brings diverse perspectives and practices to the U.S. national dialogue on mathematics education. The 2003 International Seminar brought six new teams into the dialogue on the preparation of teachers of mathematics in various countries and cultures. The new countries represented were Cameroon, Ecuador, Iran, Northern Ireland, New Zealand, and Romania, each with the customary team of two participants, one a currently practicing teacher and one an educational policy person. Reports were prepared prior to the seminar by each team, and these reports were presented, analyzed and responded to during the four-day seminar. A volume of combined proceedings of the 2002 and 2003 seminars on teacher education is being prepared. The volume will give the wider education community the opportunity to learn of common problems and promising practices coming from diverse cultural and intellectual traditions.

For the first time in 2003, PCMI hosted a laboratory class for elementary mathematics students. Distinguished mathematics educator Deborah Ball of the University of Michigan taught the five-day laboratory class for twenty Park City fifth-graders and led prebriefing and debriefing discussions with a team of observers consisting of research mathematicians, mathematics educators and classroom teachers. The focus of the week-long class was mathematical definition, embedded in an extended exercise exploring decompositions of numbers which are perfect squares. This seminar brought to the mathematics education researchers and interested research mathematicians and teachers at PCMI the opportunity to explore actual teaching practice first-hand, and to consider such questions as what kind of mathematical knowledge teachers need, what is common with themes in more advanced mathematics, and the ways in which more profound knowledge of elementary mathematics is important for quality teaching.

Cross Program Activities
A defining feature of PCMI is its focus on building understanding, professional respect and a sense of shared purpose among all the various constituents of the mathematical enterprise. To this end, a formal Cross Program Activity was held two or three afternoons each week as well as various evening activities and participant-coordinated weekend trips.

Titles of the formal 2003 Cross Program Activities were as follows:

TIMSS 1999 Video Study of Mathematics Teaching: Are the Findings Relevant for the U.S. Debates?; James Hiebert, University of Deleware
The Pythagorean Theorem and the Nine-Point Circle; Roger Howe, Yale University
Perelman's work on geometrization of 3 manifolds (including the Poincaré conjecture); John Morgan, Columbia University
Pre-concert Lecture; Robert Taub
Report on the Elementary Teaching Lab; Deborah Ball, University of Michigan
Wavelets; Lesley Ward, Harvey Mudd College
The Euclid-Euler Theorem; William Dunham, Muhlenberg College

Participants made use of their free time in such activities as swimming, hiking, and working on mathematics together. An entry in Park City's 4th of July Parade was created and executed by a cross-section of the PCMI participants. Participants also organized various sports activities that took place daily: biking, soccer, basketball, volleyball, running, etc. Weekend trips also were arranged by PCMI participants and received with enthusiasm.

Evening activities organized for the PCMI participants included:

Two barbecue dinners for participants and their families.
Pizza parties for participants and families.
A piano concert by Robert Taub, former Artist-in-Residence at the Institute for Advanced Study.

Publication Series

PCMI is very pleased to make the proceedings of its Summer Session available to the public. The full series, which comprises nearly all of the lectures ever given in PCMI's Graduate Summer School, now includes the following titles:

Volume 1: *Geometry and Quantum Field Theory*
Volume 2: *Nonlinear Partial Differential Equations in Differential Geometry*
Volume 3: *Complex Algebraic Geometry*
Volume 4: *Gauge Theory and Four Manifolds*
Volume 5: *Hyperbolic Equations and Frequency Interactions*
Volume 6: *Probability Theory and Application*
Volume 7: *Symplectic Geometry and Topology*
Volume 8: *Representation Theory of Lie Groups*
Volume 9: *Arithmetic Algebraic Geometry*

It is expected that Volumes 10 and 11 will be published in 2004.

All titles are available either from the American Mathematical Society or through popular bookstores such as Barnes and Noble.

Also published are three volumes in the *Park City Mathematics Institute Subseries* which is a subsection of the AMS *Student Mathematics Series*. These volumes are aimed at undergraduate students and are published independently of the Park City Mathematics Series mentioned above. Published thus far are:

Lectures on Contemporary Probability by Gregory F. Lawler and Lester N. Coyle
An Introduction to the Mathematical Theory of Waves by Roger Knobel
Codes and Curves by Judy L. Walker.

The High School Teacher Program will begin dissemination of its teacher-created materials and other resources sometime in 2003-2004, via a special Web site created by the Math Forum at Drexel University.

Funding

The 2003 Summer Session was made possible by the generosity of the following funders:

The National Science Foundation
State of New Jersey
Starr Foundation
National Security Agency
Geraldine R. Dodge Foundation
Mr. and Mrs. Charles L. Jaffin
The George and Dolores Doré Eccles Foundation
Bristol Myers Squibb Foundation
Wolfensohn Family Foundation
Chautauqua Programs

Oversight Board
The IAS/Park City Mathematics Institute is governed by an Oversight Board:

Chairperson:
Phillip A. Griffiths, Director, Institute for Advanced Study

Board Members:
Hyman Bass, University of Michigan
C. Herbert Clemens, Professor, The Ohio State University
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Shirley A. Hill, Professor Emeritus, University of Missouri-Kansas City
Robert D. MacPherson, Professor, School of Mathematics, Institute for Advanced Study
Elaine B. Wolfensohn, New York, New York.

Steering Committee
Members of the Steering Committee plan and manage the activities of the PCMI as follows:

Chair:
C. Herbert Clemens, Professor, University of Utah
2003 Graduate Summer School/Research Program Organizers:
Michael Christ, Professor, University of California Berkeley
Wilhelm Schlag, Professor, California Institute of Technology
Carlos Kenig, Professor, University of Chicago
Editor, Lecture Series:
David R. Morrison, Professor, Duke University
High School Teachers Program:
Gail Burrill, Instructor, Michigan State University
James R. King, Professor, University of Washington
Carol Hattan, Teacher, Skyview High School
Mathematics Education Research Program:
Joan Ferrini-Mundy, Associate Dean for Science and Mathematics Education, College of Natural Science of Michigan State University
Timothy Kelly, Professor, Hamilton College
Member at large:
John C. Polking, Professor, Rice University
Recruitment:
Nathaniel Whitaker, Professor, University of Massachusetts at Amherst
Research Program:
Karl Rubin, Professor, Stanford University
Undergraduate Faculty Program:
Daniel Goroff, Professor, Harvard University
Undergraduate Program:
William Barker, Professor, Bowdoin College
Roger Howe, Professor, Yale University

The research topic for the summer of 2004 will be *Geometric Combinatorics*, organized by Bernd Sturmfels, University of California at Berkeley; Ezra Miller, University of Minnesota; and Victor Reiner, University of Minnesota.

PROGRAM FOR WOMEN IN MATHEMATICS

The tenth annual Program for Women in Mathematics was held at the Institute for Advanced Study from May 12-22, 2003. The area of research was mathematical biology. The program, sponsored by the Institute for Advanced Study and Princeton University, is designed to bring women students in contact with postdoctoral scholars and active professional mathematicians, and to encourage women to further their mathematics education by offering deep mathematical content as well as extensive mentoring opportunities. The program consists of lectures, seminars, working problem groups, and mentoring and networking sessions. Students and mentors take part in the life of the Institute and have the opportunity to meet other mathematicians in residence here and at Princeton University.

Tandy Warnow, University of Texas at Austin, and Dorothy Buck, Brown University, taught the undergraduate course. Topics discussed in Professor Warnow's course included an introduction to mathematical phylogenetics; comparing trees – distances, consensus, and agreement methods; stochastic models of evolution and the performance of simple tree reconstruction methods; and perfect phylogenies, triangulating colored graphs, and evolutionary trees. Professor Buck's course focused on modeling interesting phenomena in molecular biology or chemistry using topological tools.

Lisa Fauci, Tulane University, and Naomi Leonard, Princeton University, gave the graduate course. The primary goal of Professor Fauci's lectures was to make students aware of how different areas of mathematics are directly applicable to problems in biology and physiology, and to introduce them to open problems that could be the subject of graduate research projects. Professor Leonard presented a collection of results from nonlinear control theory: stability and robustness analysis, controllability and control design, geometric approaches, and illustrated their application to understanding and emulating the behavior of individual animals and animal groups. She emphasized the range of mathematics used in control theory and the ubiquity of control in biology and biology-inspired robotics. In addition to program participants, both the undergraduate and graduate courses had a number of attendees from the Institute for Advanced Study and from Princeton University as well as other institutions in the area. A daily schedule was posted on the website.

Karen Uhlenbeck, University of Texas at Austin, led the Women-in-Science Seminar assisted by Michelle Swenson, University of Texas at Austin. A session on "Balancing Career and Family," was led by a panel consisting of Cynthia Curtis, The College of New Jersey, Antonella Grassi, University of Pennsylvania, Nancy Hingston, The College of New Jersey, and Susan Szczepanski, Lehigh University.

Brynja Kohler, University of Utah, and Cymra Haskell, University of Southern California, organized the Research Seminars. The following seminars were presented during the program: Christine Heitsch, University of Wisconsin-Madison, *Computational and Combinatorial Aspects of RNA Secondary Structures*; Genetha Gray, Sandia National Labs, *Two Examples of Simulation-Based Optimization*; Martin Nowak, Institute for Advanced Study, *Evolution of Language and Evolutionary Game Theory*; Florence Lin, University of Southern California, *Towards applications of geometric mechanics to biological macromolecules*; Katherine Kirkwood, Sweet Briar College, *Blood glucose fluctuation characteristics in type 1 vs. type 2 diabetes mellitus*; Rachel Ward, University of Texas at Austin, *Finding minimal length paths subject to curvature constraint*; Lara Baumann, UCLA School of Medicine,

Statistical genetics; Franziska Michor, Harvard University, and Yoh Iwasa, Institute for Advanced Study and Kyushu University, *Somatic Evolution of Cancer*; Angela Gallegos, University of California at Davis, *Myxococcus xanthus: How fast do they move?*; Gerusa Araujo, Laboratorio Nacional de Computacao Cientifica, *Modeling of Flagellar Motility via Geometric Mechanics and Bacterial Flagellar Motor*; and Adriana Dawes, University of British Columbia, *Towards a model of cell motility*.

Princeton University professors Alice Chang and Ingrid Daubechies and graduate student Cynthia Rudin planned a special day of lectures and other activities at Princeton University on Monday, May 19. The day ended with a panel discussion arranged by the Noetherian Ring, followed by a reception and dinner.

Program for Women in Mathematics Organizing Committee

The Women's Program Committee assists in planning and promoting the program and recruiting lecturers and participants. The program was organized by Karen Uhlenbeck, the Sid W. Richardson Foundation Regents' Chair in Mathematics at the University of Texas at Austin, and Mary Pugh, Professor of Mathematics, University of Toronto. Committee members include: Ranee Brylinski, Brylinski Research; Alice Chang, Princeton University; Ingrid Daubechies, Princeton University; Joan Feigenbaum, Yale University; Antonella Grassi, University of Pennsylvania; Nancy Hingston, The College of New Jersey; Rhonda Hughes, Bryn Mawr College; Robert MacPherson, Institute for Advanced Study; Cynthia Rudin, Graduate Student, Princeton University; Janet Talvacchia, Swarthmore College; and Lisa Traynor, Bryn Mawr College.

10th Anniversary Reunion Celebration

This year marked the 10th Anniversary of the Program for Women in Mathematics at the Institute for Advanced Study. To celebrate the occasion, all past participants were invited to the Institute May 16-18, for a weekend of talks, research poster sessions, panels and social activities. Over the past ten years, hundreds of young women have participated in the program and gone on to successful and rewarding careers in mathematics. The field is enriched by their presence. The following is the schedule for the reunion weekend:

Friday, May 16

5:00 p.m. Philip Holmes, Professor of Mechanical and Aerospace Engineering, Princeton University
Optimal decisions in the brain: From neural oscillators to stochastic differential equations
Wolfensohn Hall

6:30 p.m. Reception and Dinner

Saturday, May 17

9:30 a.m. Research Poster Session (organized by Cynthia Rudin, Princeton University graduate student and member of the Program Committee)
Dilworth Room

11:00 a.m. Phillip A. Griffiths, Director, Institute for Advanced Study
A simple classical question that leads unavoidably to a 'post-modern' mathematical object
Simonyi Hall Seminar Room

1:30 p.m. Tamar Friedmann, Princeton University (Mathematical Physics)
From Kaluza-Klein to M-theory: on dualities and unification
Simonyi Hall Seminar Room
3:00 p.m. Research Poster Session
Dilworth Room
4:00 p.m. Sema Salur, Northwestern University (Geometry)
Calibrated Geometries and Mirror Symmetry
Simonyi Hall Seminar Room
6:30 p.m. Barbecue supper
7:30 p.m. Panel Discussion

Sunday, May 18

9:00 a.m. Amber Puha, California State University at San Marcos (Probability)
Fluid and Diffusion Approximations for a Heavily Loaded Processor Sharing Queue
Simonyi Hall Seminar Room
10:30 a.m. Rachel Pries, Columbia University (Arithmetic Algebraic Geometry)
Symmetries of Equations: history, applications, and Galois covers of curves in characteristic p
Simonyi Hall Seminar Room

We are grateful to the senior women mathematicians who have given their time and talent to this program over the past ten years and to the young women it serves. Members of the Program Committee, organizers, and lecturers all have served for many years and without compensation. The program would not have been possible without the commitment of these dedicated leaders and, in particular, Karen Uhlenbeck, the program founder, and Chuu-Lian Terng, her longtime collaborator and co-organizer of many years. Many talented young women entered mathematics or persevered in the field because of the encouragement and support of Karen and Chuu-Lian and countless other senior women.

We are grateful to the Friends of the Institute for Advanced Study and to the Starr Foundation for their generous support of the Program for Women in Mathematics.

PROSPECTS IN THEORETICAL PHYSICS

Pilot Year 2002

Under the auspices of the School of Natural Sciences, the Institute for Advanced Study offered its first orientation and mentoring program for graduate students interested in theoretical physics. The program, "Introduction to String Theory," took place July 1-12, 2002. It was designed to provide the students with information on the latest advances and open questions in the field, the techniques required, and the most likely scenario for future research directions.

The program drew 90 regular participants and 30 registered auditors, as well as many graduate students, post-docs, and faculty from Princeton University and other nearby institutions. The students came from 50 different U.S. institutions, and from South Korea, India, Brazil, Mexico, Canada, and England. The participation of women, minori-

ties, and students from institutions that do not have extensive programs in theoretical physics, or access to research universities, was especially encouraged.

Members of the organizing committee were Chiara R. Nappi, Princeton University; Curtis G. Callan, Princeton University; Louise A. Dolan, University of North Carolina, Chapel Hill; Juan Maldacena, Institute for Advanced Study; Leopoldo Pando Zayas, University of Michigan; and Alfred Shapere, University of Kentucky. Among the local physicists who presented lectures were Steven Gubser, Igor Klebanov, and Paul Steinhardt of Princeton University, and Juan Maldacena, Nathan Seiberg, and Edward Witten of the Institute for Advanced Study. Other lecturers were Mirjam Cvetic, University of Pennsylvania; S. J. Gates, University of Maryland; Brian Greene, Columbia University; Clifford V. Johnson, University of Durham; Sheldon Katz, University of Illinois; Sunil Muhki, Tata Institute of Fundamental Research; Amanda W. Peet, University of Toronto; Leopoldo Pando Zayas, University of Michigan; Eva Silverstein, Stanford University; and Scott Thomas, also from Stanford University.

The scientific program was comprised of six hours of daily lectures augmented by evening discussion groups, allowing time for questions and more in-depth explorations of the concepts presented in the lectures. There was a mosaic of basic and advanced talks, to meet the needs of a varied student body. Areas related to string theory, such as particle phenomenology and cosmology, were also addressed in a detailed and substantive way. In addition to the formal activities, registered participants were invited to join the lecturers for informal discussion and interaction over lunch.

Prospects in Theoretical Physics is one of the first outreach activities the Institute for Advanced Study has created specifically for graduate students. Because of its strength as a center for research in theoretical physics, the Institute is uniquely positioned to contribute to efforts to attract and retain this next generation of young physicists, thereby providing an important service to the field of theoretical physics. The 2002 program was made possible with support from the J. Seward Johnson, Sr. Charitable Trusts and the Friends of the Institute for Advanced Study.

Second Year 2003

The 2003 Prospects in Theoretical Physics program, "Cosmology, Particles, and Strings," was held on the Institute for Advanced Study campus June 30-July 11. The program was designed for advanced physics graduate students interested in cosmology as well as for astrophysics graduate students interested in particle physics. Particular emphasis was put on questions and problems that the disciplines of physics and astrophysics can cooperatively address.

The PiTP 2003 organizing committee was chaired by Chiara R. Nappi, Princeton University, and included John N. Bahcall, Institute for Advanced Study and Princeton University professors Neta Bahcall, David N. Spergel, and Paul J. Steinhardt. As in 2002, the organizers encouraged the participation of women, minorities, and students from institutions with smaller programs in astrophysics and particle physics.

More than 100 young physicists attended PiTP 2003 and lived in the Institute's housing complex during the two-week program. Daily commuters included 30 students from

Princeton University as well as many students, post-docs and faculty members from Rutgers University, University of Pennsylvania, and other nearby institutions.

Lecturers included members of the organizing committee as well as Juan Maldacena and Edward Witten of the Institute for Advanced Study; Steve Gubser, Peter D. Meyers, Bohdan Paczynski, Lyman A. Page, Jr., Phillip James E. Peebles, Uros Seljak, Thomas A. Shutt, Suzanne T. Staggs, Michael A. Strauss, Licia Verde and Herman Verlinde of Princeton University; Stephen Boughn, Haverford College; Arthur Kosowsky, Rutgers University; Arlie O. Petters, Duke University; Paul G. Langacker, University of Pennsylvania; and Neil Turok, Cambridge University. In addition, Neil deGrasse Tyson, director of the Rose Research Center of the Hayden Planetarium in New York City, hosted a session at the planetarium on July 4.

The scientific program was intense with five hours of lectures each day. The goal was to expose the students to as many techniques and ideas as possible, and to do this in a detailed and substantive way so that they would emerge from this program with some concrete learning. The emphasis was on cosmology, and only topics in particle phenomenology and string theory were covered that were of relevance to astrophysics and cosmology. The emphasis was on the interplay between these fields.

On July 10, participants went to Princeton University for a day of lectures and activities sponsored by the physics and astrophysics departments. In the morning, there were talks by experimental cosmologists presenting the latest discoveries in the cosmic microwave background WMAP data followed by lunch in the physics department. The students visited the labs of the gravity group and then went to the astrophysics department for talks on neutrinos (including solar neutrinos), and dark matter searches. The day at Princeton University stressed the important role of experiments in theoretical physics, and it exemplified that PiTP is, in many respects, a joint effort between the Institute for Advanced Study and Princeton University.

Prospects in Theoretical Physics 2003 was supported by The Concordia Foundation, the J. Seward Johnson, Sr. Charitable Trusts, the National Science Foundation and the Friends of the Institute for Advanced Study.

"My participation in PCMI has profoundly changed my classroom teaching. At PCMI, I was asked to learn new mathematics and explore information I did not already know or understand. Namely, I was asked to truly become a mathematics student again, and that has made me a better teacher."

—Participant, PCMI Summer Session

Participants in the Institute for Advanced Study's Program for Women in Mathematics included (from left) Tanya Cofer, University of Georgia; Marylea Ryan, Smith College; lecturer Dusa McDuff, State University of New York at Stony Brook and Institute for Advanced Study Member 1976-77 and 2001-02; and Olguta Buse, State University of New York at Stony Brook. Dusa McDuff and Olguta Buse were also participants in the Institute for Advanced Study/Park City Mathematics Institute (PCMI).

The Historical Studies-Social Science Library (Marcia Tucker, Librarian) contains some 100,000 volumes and has subscriptions to about 1,000 journals. The library is strongest in classical studies, ancient history, and archaeology, but it contains basic document collections, reference works, and important secondary works of scholarship in most fields of history and the social sciences. The journal collection is extensive, and fairly complete back runs exist to the founding of the Institute. The library has occupied its present building since 1964.

The Institute's rare book collection, the gift of Lessing J. Rosenwald, consists of about 2,000 volumes on the history of science and was compiled by Herbert M. Evans in the 1930s. The collection, which is housed in a special room, includes numerous first editions of important scientific works in mathematics, astronomy, physics, and the life sciences.

The library has an extensive collection of offprints including those received by Professors Andrew E.Z. Alföldi, Kurt Gödel, Ernst H. Kantorowicz, Elias Avery Lowe, Millard Meiss, Erwin Panofsky, and former Members Robert Huygens and Walther Kirchner.

The microfilm collections of the library include a large selection from Manuscripta, a collection of several thousand fifteenth- to nineteenth-century printed books from the Vatican Library. The Bavarian Academy has given the Institute a microfilm copy of slips presented for the *Thesaurus Linguae Latinae*. The library has microfilm copies of the papers of both Kurt Gödel and Simone Weil.

The Historical Studies-Social Science Library houses the Institute archives. The papers in the collection date from the 1930s and include official correspondence of the Director's Office, minutes of meetings of the Faculty and the Board of Trustees, miscellaneous correspondence concerning past Faculty members, records of the Electronic Computer Project, and other documents. The archives also include the Institute's photograph collection.

The Mathematics-Natural Sciences Library (Momota Ganguli, Librarian) is located on the second floor of Fuld Hall and contains some 30,000 volumes (bound periodicals and monographs) plus subscriptions to nearly 180 journals. Its collection of older periodicals is housed in compact shelving on the lower level of the Historical Studies-Social Science Library. The subject areas covered by the library are pure and applied mathematics, astrophysics, and theoretical, particle, and mathematical physics.

Both of the Institute's libraries participate in the shared cataloging system of the Research Libraries Group, which gives Institute scholars computerized access to a database that contains more than twenty-two million records. Searches of this database retrieve bibliographic information and identify the location of materials in all participating libraries.

Access to electronically-cataloged titles is available via Horizon, the Institute's web-accessible online catalog. The Institute's libraries are participants in the JSTOR project, which makes available archival electronic versions of many core journals in mathematics and the humanities.

The Historical Studies-Social Science Library maintains a computer center with access to a variety of word processing packages for both PCs and Macintoshes, access to databases in the fields of Classical Studies, the History of Science, Islamic and French studies, and connection software to the Internet for additional information resources. The Mathematics-Natural Sciences Library's electronic resources include an online catalog, a variety of indexes, and a growing collection of full-text journals.

All scholars affiliated with the Institute enjoy the same privileges as Princeton University faculty in the Harvey S. Firestone Memorial Library and the nineteen special-subject libraries in the Princeton University Library system and also in the Robert E. Speer Library of the Princeton Theological Seminary.

The librarians and the faculties of all four Schools at the Institute warmly appreciate gifts of books and articles from former and current Members of the Institute.

"I very much enjoyed conversations with the Institute's Faculty, and I am very thankful for their critical engagement with the various works I am completing. The Institute's material and human environment is the most conducive to intellectual work.... This has been the most intellectually invigorating and productive year of my academic career. Thank you for this possibility."

—Member, School of Social Science

INDEPENDENT AUDITORS' REPORT

The Board of Trustees,
Institute for Advanced Study -
Louis Bamberger and Mrs. Felix Fuld Foundation

We have audited the accompanying balance sheet of Institute for Advanced Study - Louis Bamberger and Mrs. Felix Fuld Foundation (the "Institute") as of June 30, 2003, and the related statements of activities and cash flows for the year then ended. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit. The prior year's summarized comparative information has been derived from the Institute's June 30, 2002 financial statements, and in our report dated October 3, 2002, we expressed an unqualified opinion on those financial statements.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, such financial statements present fairly, in all material respects, the financial position of the Institute at June 30, 2003, and the changes in its net assets and its cash flows for the year ended June 30, 2003, in conformity with accounting principles generally accepted in the United States of America

Deloitte & Touche LLP

October 13, 2003
Parsippany, New Jersey

BALANCE SHEET
JUNE 30, 2003 (WITH COMPARATIVE TOTALS FOR 2002)

ASSETS	2003	2002
CASH	$ 427,017	$ 3,315,416
SHORT-TERM INVESTMENTS - Held by Trustee	2,700,144	6,513,551
ACCOUNTS RECEIVABLE	242,692	251,086
GOVERNMENT GRANTS AND CONTRACTS RECEIVABLE	2,245,288	1,197,996
ACCRUED INVESTMENT INCOME	859,650	1,736,677
PREPAID AND OTHER ASSETS	609,139	444,414
CONTRIBUTIONS RECEIVABLE - NET	650,074	1,052,784
UNAMORTIZED DEBT ISSUANCE EXPENSE - NET	681,648	734,743
LAND, BUILDINGS AND IMPROVEMENTS, EQUIPMENT AND RARE BOOK COLLECTION - NET	49,277,972	50,685,856
INVESTMENTS	375,039,116	360,898,411
TOTAL ASSETS	$432,732,740	$ 426,830,934

See notes to financial statements.

LIABILITIES AND FUND BALANCES	2003	2002
ACCOUNTS PAYABLE AND ACCRUED EXPENSES	$ 10,163,108	$ 9,390,712
REFUNDABLE ADVANCES	5,756,456	7,038,322
LIABILITIES UNDER SPLIT-INTEREST AGREEMENTS	2,258,924	2,644,820
NOTE PAYABLE	921,457	977,968
ACCRUED INVESTMENT MANAGEMENT FEES	41,443	439,878
LONG-TERM DEBT	48,633,307	50,039,739
Total liabilities	67,774,695	70,531,439
NET ASSETS:		
Unrestricted	241,044,050	235,673,809
Temporarily restricted	78,251,103	76,440,117
Permanently restricted	45,662,892	44,185,569
Total net assets	364,958,045	356,299,495
TOTAL LIABILITIES AND NET ASSETS	$ 432,732,740	$ 426,830,934

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2003 (WITH COMPARATIVE TOTALS FOR 2002)

	UNRESTRICTED	TEMPORARILY RESTRICTED
REVENUES, GAINS AND OTHER SUPPORT:		
Private contributions and grants	$ 3,200,220	$ 4,677,659
Government grants	-	4,231,644
Income on long-term investments	4,515,877	2,364,532
Net realized and unrealized gains and on long-term investments (includes $5,849,647 and $3,975,096 in unrealized gains in 2003 and 2002, respectively)	15,915,965	7,608,896
Gain on sale of capital assets	257,503	-
Net assets released from restrictions - satisfaction of program restrictions	17,230,705	(17,230,705)
Total revenues, gains and other support	41,120,270	1,652,026
EXPENSES:		
School of Mathematics	7,147,007	-
School of Natural Sciences	6,244,583	-
School of Historical Studies	5,187,322	-
School of Social Science	3,088,458	-
Libraries and other academic expenses	5,997,577	-
Administration and general	7,513,762	-
Auxiliary activity - tenants' housing expenses, net of unrestricted revenue $237,481	412,360	-
Total expenses	35,591,069	-
CHANGES IN NET ASSETS	5,529,201	1,652,026
NET ASSETS, BEGINNING OF YEAR	235,673,809	76,440,117
NET ASSETS, END OF YEAR	$241,203,010	$ 78,092,143

See notes to financial statements.

2003

PERMANENTLY RESTRICTED	TOTAL 2003	TOTAL 2002
$ 1,477,323	$ 9,355,202	$ 13,230,843
-	4,231,644	4,026,663
-	6,880,409	5,010,670
-	23,524,861	9,432,806
-	257,503	338,886
-	-	-
1,477,323	44,249,619	32,039,868
-	7,147,007	6,827,460
-	6,244,583	5,977,443
-	5,187,322	5,134,357
-	3,088,458	2,817,533
-	5,997,577	5,309,645
-	7,513,762	6,740,493
-	412,360	377,609
-	35,591,069	33,184,540
1,477,323	8,658,550	(1,144,672)
44,185,569	356,299,495	357,444,167
$45,662,892	$ 364,958,045	$ 356,299,495

STATEMENT OF CASH FLOWS
YEAR ENDED JUNE 30, 2003 (WITH COMPARATIVE TOTALS FOR 2002)

	2003	2002
CASH FLOWS FROM OPERATING ACTIVITIES:		
Change in net assets	$ 8,658,550	$ (1,144,672)
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Depreciation	3,435,000	3,077,870
Gain on sale of capital assets	(257,503)	(338,886)
Contributions restricted for long-term investments	(1,770,627)	(1,781,121)
Net realized and unrealized gains on long-term investments	(23,683,821)	(9,432,806)
Amortization of debt issuance expense	53,095	54,703
Amortization of bond discount	38,568	41,480
Changes in assets/liabilities:		
(Increase) decrease in accounts receivable, and grants and contracts receivable	(1,038,898)	173,172
Decrease (increase) in accrued investment income	877,027	(180,737)
Increase in prepaid and other assets	(164,725)	(132,897)
Decrease (increase) in contributions receivable	402,710	(258,029)
Increase in accounts payable	772,396	915,117
(Decrease) increase in refundable advances	(1,281,866)	80,065
Decrease in accrued management fees	(398,435)	(1,420,710)
Net cash used in operating activities	(14,358,529)	(10,347,451)
CASH FLOWS FROM INVESTING ACTIVITIES:		
Proceeds from sale of capital assets	2,299,072	426,330
Purchase of capital assets	(4,068,685)	(8,560,175)
Proceeds from sale of investments	958,000,243	662,677,706
Purchase of investments	(948,457,127)	(650,800,479)
Net cash provided by investing activities	7,773,503	3,743,382
CASH FLOWS FROM FINANCING ACTIVITIES:		
Proceeds from contributions restricted for:		
Investment in endowment	1,734,793	1,699,198
Investment in plant	35,834	81,923
	1,770,627	1,781,121
Other financing activities:		
Decrease in liabilities under split-interest agreements	(385,896)	(125,102)
Repayment of long-term debt	(1,445,000)	(1,196,784)
Repayments of note payable	(56,511)	(55,397)
Decrease in investments held by trustee	3,813,407	6,633,204
	1,926,000	5,255,921
Net cash provided by financing activities	3,696,627	7,037,042
NET (DECREASE) INCREASE IN CASH	(2,888,399)	432,973
CASH, BEGINNING OF YEAR	3,315,416	2,882,443
CASH, END OF YEAR	$ 427,017	$ 3,315,416
SUPPLEMENTAL DATA:		
Interest paid	$ 2,956,387	$ 2,585,278

See notes to financial statements.

NOTES TO FINANCIAL STATEMENTS
YEAR ENDED JUNE 30, 2003

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The Institute for Advanced Study (the "Institute"), an independent, private institution devoted to the encouragement, support and patronage of learning, was founded in 1930 as a community of scholars where intellectual inquiry could be carried out in the most favorable circumstances.

Focused on mathematics and classical studies at the outset, the Institute today consists of the School of Historical Studies, the School of Mathematics, the School of Natural Sciences and the School of Social Science. Each school has a small permanent faculty, and some 190 fellowships are awarded annually to visiting members from other research institutions and universities throughout the world.

The objectives of the Institute were described as follows in the Founders' original letter to the first Trustees: "The primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the institution and the ability of the faculty and students will permit."

Basis of Presentation – The accompanying financial statements are prepared on the accrual basis and are presented in accordance with recommendations contained in Not-for-Profit Organizations issued by the American Institute of Certified Public Accountants.

The reporting of contributions and pledges distinguishes between contributions received that increase permanently restricted net assets, temporarily restricted net assets, and unrestricted net assets. Recognition of the expiration of donor-imposed restrictions occurs in the period in which the restrictions expired.

Net assets and revenue, gains and losses are classified based on the existence or absence of donor-imposed restrictions. Amounts for each of the three classes of net assets - permanently restricted, temporarily restricted and unrestricted - are displayed in the statement of activities.

Fund Accounting – The accounts of the Institute are maintained in accordance with the principles of "fund accounting." This is the procedure by which resources for various purposes are classified for accounting purposes into funds that are in accordance with activities or objectives specified. Separate accounts are maintained for each fund.

True endowment funds are subject to the restrictions of the gift instruments, which require that the principal be invested in perpetuity; only income earned and gained on such funds may be utilized. Quasi-endowment funds have been established by the governing board to function as endowment funds and any portion of these funds may be expended. Unrestricted quasi-endowment funds have no external restrictions. However, certain of these funds have been internally designated to support specific needs of the Institute.

All gains and losses arising from the sale, collection, or other disposition of investments and other noncash assets are accounted for in the fund that owned such assets. Ordinary

income earned on investments and receivables is generally accounted for in the fund owning such assets. However, unrestricted income earned on investments of endowment and similar funds is accounted for as revenue in unrestricted operating funds, and restricted income is accounted for as deferred restricted revenue until used in accordance with the terms of the restriction or transferred to endowment and similar funds.

Restricted Net Assets – The Institute has classified gifts of cash and other assets as restricted net assets, if they are received with donor specifications, as either temporarily restricted or permanently restricted net assets. Temporarily restricted net assets are amounts that have been restricted in purpose and/or time by donor specification. Permanently restricted net assets have resulted from donors' specifications that contributions be invested in perpetuity and that, generally, only the income generated on such amounts be used. When a donor restriction expires, that is, when a stipulated time restriction ends or purpose restriction is accomplished, temporarily restricted net assets are reclassified to unrestricted net assets and reported in the statement of activities as net assets released from restrictions.

Use of Estimates – The preparation of financial statements in conformity with generally accepted accounting principals requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenues and expenses during the reported period. Actual results could differ from those estimates.

Cash and Cash Equivalents – The Institute considers all highly liquid short-term investments purchased with an original maturity of less than three months to be cash equivalents. The Institute maintains demand deposits with major banks, the majority of which are held in one bank.

Contributions Receivable – The Institute records unconditional promises to give (pledges) at the fair value on the date received. The Institute's policy regarding the recording of promises to give is to include all promises received during the last five years as pledges receivable. A reserve for uncollectible promises is recorded to reduce the total pledge amount to its realizable value. Pledges are recorded at the present value of their expected future cash flows, net of allowance for doubtful accounts. The discount rates used for multi-year pledges are based on treasury bond rates which, commensurate to the term that the pledges are due. The discount rates range from 1.09% to 5.65%. Amortization of the discount is included in gifts and donation revenue.

Investments – All short-term investments and investments in marketable debt securities are reported in the financial statements at fair value, based upon quoted market price. Investments in limited partnerships are accounted for under a modified equity method whereby the Institute recognizes its proportionate share of ordinary income/expenses and net realized gains/losses attributable to the investments of the partnerships. Investments in hedge and offshore funds (the "Funds") are accounted for at the lower of cost or market value. Fair value for these investments is determined as the number of shares held by Institute multiplied by the net asset value for such shares. Net asset value, as determined by the Funds, reflects the underlying assets held by the Funds and any investment gain or loss.

The statement of activities recognizes unrealized gains and losses on investments as increases and decreases, respectively, in unrestricted net assets unless their use is tem-

porarily or permanently restricted by explicit donor stipulation. Purchase and sale transactions are recorded on a settlement date basis. Gains and losses on the sale of investment securities are calculated using the specific identification method.

The Institute regularly offers first and second mortgages to full-time faculty, administrative employees, and resident scholars who have met certain requirements stipulated by the Board.

Plant Assets and Depreciation – Proceeds from the sale of plant assets, if unrestricted, are transferred to operating funds, or, if restricted, to amounts temporarily restricted for plant acquisitions.

Depreciation is provided over the estimated useful lives of the respective assets on a straight-line basis (buildings and capital improvements 20-40 years, equipment 3-6 years).

Refundable Advances – Conditional amounts are recorded initially as deferred restricted revenue, and are reported as revenues when expended in accordance with the terms of the condition or transferred to the quasi-endowment funds.

Split Interest Agreements - The Institute is the beneficiary of various unitrusts and pooled income funds. The Institute's interest in these split interest agreements is reported as a contribution in the year received and is calculated as the difference between the fair value of the assets contributed to the Institute, and the estimated liability to the beneficiary. This liability is computed using actuarially determined rates and is adjusted annually. The assets held by the Institute under these arrangements are recorded at fair value as determined by quoted market price and are included as a component of investments.

Unamortized Debt Issuance Costs – Debt issuance costs represent costs incurred in connection with debt financing. Amortization of these costs is provided on the effective interest method extending over the remaining term of the applicable indebtedness. Deferred financing costs at June 30, 2003 were net of accumulated amortization of $285,141.

Tax Status - The Institute is exempt from Federal income taxes pursuant to Section 501(c)(3) of the Internal Revenue Code and is listed in the Internal Revenue Service Publication 78.

2. CONTRIBUTIONS RECEIVABLE

Unconditional promises to give at June 30, 2003 were as follows:

Unconditional promises to give:	
Less than one year	$ 263,696
One to five years	406,000
	669,696
Discount on promises to give	(19,622)
	$ 650,074

3. INVESTMENTS

Endowment and similar funds investments at June 30, 2003 are comprised of the following:

	REPORTED VALUE	FAIR VALUE
Short-term investments	$ 564,133	$ 564,133
Limited partnerships	100,866,412	115,119,556
Hedge and offshore funds	104,548,428	153,381,855
Debt securities	161,214,500	161,214,500
Mortgages from faculty and staff	4,352,230	4,352,230
Total pooled investments	371,545,703	434,632,274
Funds invested separately:		
Charitable remainder and pooled income trusts	3,493,413	3,493,413
Total	$ 375,039,116	$ 438,125,687

The Institute's proportionate share of ordinary expense and net realized gains attributed to its limited partnership investments was $1,143,852 and $800,113, respectively, for the year ended June 30, 2003.

The Institute's interests in limited partnerships and Funds represent 27% and 28%, respectively, 55% collectively of total investments held by the Institute at June 30, 2003. These instruments may contain elements of both credit and market risk. Such risks include, but are not limited to, limited liquidity, absence of regulatory oversight, dependence upon key individuals, emphasis on speculative investments (both derivatives and non-marketable investments) and nondisclosure of portfolio composition.

Substantially all of the assets of endowment and similar funds are pooled with each individual fund subscribing to or disposing of units on the basis of the market value per unit, determined on a quarterly basis.

The following table summarizes the investment return and its classification in the statement of activities for the year ended June 30, 2003:

	UNRESTRICTED	TEMPORARILY RESTRICTED	TOTAL
Dividends and interest	$ 4,515,877	$2,364,532	$ 6,880,409
Realized gain on investments reported at fair value	$ 7,846,494	$3,897,953	$11,744,447
Realized gain on investments reported at other than fair value	4,068,562	2,021,165	6,089,727
Total realized gain	11,915,056	5,919,118	17,834,174
Unrealized gain	4,000,909	1,848,738	5,849,647
Total realized and unrealized gain	$15,915,965	$7,767,856	$23,683,821

Short-term investments held by trustee represent the balance of the proceeds from the 1997 and 2001 NJEFA bonds that have not yet been expended for construction purposes. These funds are being held in trust by The Bank of New York. Such funds are invested in U.S. Government obligations with maturities of less than one year. At June 30, 2003, the market value of such securities approximates their carrying value.

During July 2003, the Institute invested $60,000,000 in four additional offshore private funds. Funds were obtained through a partial liquidation of the Institute's fixed income (debt) portfolio.

4. PHYSICAL PLANT

Physical plant and equipment are stated at cost at date of acquisition, less accumulated depreciation. Library books, other than rare books, are not capitalized.

A summary of plant assets at June 30, 2003 follows:

Land and improvements	$ 1,243,861
Buildings and improvements	67,779,597
Equipment	18,583,394
Rare book collection	203,508
Joint ownership property	1,521,717
Total	89,332,078
Less accumulated depreciation	(40,054,106)
Net book value	$49,277,972

During 1997, the Institute entered into a Deed of Pathway and Conservation Easement (the "Easement") whereby the Institute has received $11,794,600 in cash and $1,274,196 in contributions receivable at June 30, 1997, in consideration for the sale of land development rights for certain Institute properties. The Easement requires that those properties, set forth therein, be preserved to the greatest extent possible in their existing natural, scenic, open, wooded and agricultural state and be protected from uses inconsistent therewith.

Of the $11,794,600 in cash received by the Institute, $5,625,000 represents monies received from the New Jersey Green Acres Fund to be repaid by the parties to the Easement. The Institute's pro rata share of $921,457 has been recorded as a note payable in the accompanying statement of financial position at June 30, 2003. The note payable bears interest at a rate of 2% and requires semi-annual payments through January 8, 2017.

The note is payable as follows at June 30, 2003:

2004	$ 57,647
2005	58,805
2006	59,987
2007	61,193
2008	62,423
Through 2017	621,402
Total note payable	$ 921,457

5. LONG-TERM DEBT

A summary of long-term debt at June 30, 2003 follows:

Series F & G 1997 - NJEFA	$38,335,000
Series A 2001 - NJEFA	10,805,000
Less unamortized bond discount	(506,693)
Total long-term debt	$48,633,307

Interest expense on long-term debt for the year ended June 30, 2003 was $2,633,986.

In November 1997, the Institute received proceeds of the New Jersey Educational Facilities Authority offering of $16,310,000 Revenue Bonds, 1997 Series F and $26,565,000 Revenue Bonds, 1997 Series G of the Institute for Advanced Study Issue. A portion of the proceeds ($16,969,355) was used to retire the existing Revenue Bonds, 1991 Series. The remainder of the proceeds was used for renovations of members housing. In May 2001, the Institute received proceeds of the New Jersey Educational Facilities Authority offering of $11,000,000 Revenue Bonds, 2001 Series A of the Institute for Advanced Study issue. Proceeds were used for the construction of Bloomberg Hall and additional capital projects.

The bonds bear interest at rates ranging from 4% to 5%, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2031. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute.

The bonds are repayable as follows at June 30, 2003:

2004	1,515,000
2005	1,585,000
2006	1,665,000
2007	1,745,000
2008	1,825,000
Through 2031	40,805,000
Total	$ 49,140,000

6. PENSION PLANS AND OTHER POSTRETIREMENT BENEFITS

Separate voluntary defined contribution retirement plans are in effect for faculty members and eligible staff personnel, both of which provide for annuities, which are funded, to the Teachers Insurance and Annuity Association and/or the College Retirement Equities Fund. Contributions are based on the individual participants' compensation in accordance with the formula set forth in the plan documents on a nondiscriminatory basis. Contributions for the year ended June 30, 2003 totaled approximately $1,431,874.

In addition to providing pension benefits, the Institute provides certain health care and life insurance benefits for retired employees and faculty. Substantially, all of the Institute's employees may become eligible for these benefits if they meet minimum age and service

requirements. The Institute accrues these benefits over a period in which active employees become eligible under existing benefit plans.

The components of the periodic expense for these postretirement benefits for 2003 are as follows:

Postretirement Benefit Costs:	
Service Cost - benefits attributable to service during the year	$ 115,662
Interest Cost on Accumulated Postretirement Benefit Obligation	337,323
Total	$ 452,985

The actuarial and recorded liabilities for these benefits, none of which have been funded, are as follows at June 30, 2003:

Accumulated postretirement benefit obligation:	
Retirees	$2,681,838
Fully eligible active plan participants	895,815
Other active plan participants	1,417,410
Total	$4,995,063

For measurement purposes, an 11.0% trend rate was used for 2001 health care costs, with the rate decreasing ratably until the year 2009, and then remaining constant at 5.0% thereafter. The health care cost trend rate assumption has a significant effect on the amounts reported. For example, a 1% increase in the health care trend rate would increase the accumulated postretirement benefit obligation by approximately $656,000 at June 30, 2003 and the net periodic cost by approximately $85,000 for the year. The weighted average discount rate used in determining the accumulated postretirement benefit obligation was 7.5%.

7. FUNDS HELD IN TRUST BY OTHERS

The Institute is the residuary beneficiary of a trust and, upon the death of the life tenant, will be entitled to receive the corpus thereof. The approximate market value of the trust's assets, as reported by the administrator of the trust, aggregated $3,296,756 as of June 30, 2003, and is not included in the accompanying financial statements.

8. FUNCTIONAL ALLOCATION OF EXPENSES

The costs of providing the various programs and other activities have been summarized on a functional basis in the statement of activities and cash flows. Accordingly, certain costs have been allocated among the programs and supporting services benefited. The net costs incurred by the Institute in operating both the Dining Hall ($444,957 net of $783,366 in revenues) and members' housing ($1,820,337 net of $1,386,510 in revenues) have been allocated among the programs and supporting services benefited. Included in the net costs incurred by the Institute that are allocated among the programs is $1,126,680 of depreciation expense. An overhead charge is allocated to certain schools generally based upon their ability to recover such costs under the terms of various grants and contracts. Overhead allocated from administration and general expenses to various programs totaled $4,659,349 for the year ended June 30, 2003.

Interest expense on plant fund debt, net of interest income on short-term investments, is allocated to schools based upon their occupancy of academic buildings funded with such debt. Allocated interest expense totaled $2,089,619 and allocated interest income totaled $38,229 for the year ended June 30, 2003.

The Institute provides academic services to a community of scholars, including permanent faculty and visiting members. Expenses related to providing these services are as follow:

	2003
Expenses incurred were for:	
Salaries, wages, and benefits	$18,356,449
Stipends	6,148,525
Honoraria	344,258
Grants to other organizations	287,731
Supplies and travel	2,588,853
Services and professional fees	4,083,618
Depreciation	2,308,318
Interest	1,473,317
Total expenses	$35,591,069

9. TEMPORARILY AND PERMANENTLY RESTRICTED ASSETS

Restricted net assets are available for the following purposes at June 30, 2003:

Temporarily restricted net assets are restricted to:	
Academic Services:	
Educational Programs	$78,251,103
Permanently restricted net assets are restricted to:	
Investments to be held in perpetuity, the income from which is expendable to support academic services	$45,662,892

Net assets were released from donor restrictions by incurring expenses satisfying the restricted purposes or by occurrence of other events specified by donors.

10. DISCLOSURES ABOUT FAIR VALUE OF FINANCIAL INSTRUMENTS

The Institute is required by SFAS No. 107, *Disclosure About Fair Value of Financial Instruments*, to disclose the estimated fair value of financial instruments, both assets and liabilities recognized and not recognized in the balance sheet, for which it is practicable to estimate fair value.

The estimated fair value amounts in the following disclosure have been determined by the Institute using available market information and appropriate valuation methodologies. The estimates are not necessarily indicative of the amounts the Institute could realize in a current market exchange, and the use of different market assumptions or methodologies could have a material effect on the estimated fair value amounts.

June 30, 2003	REPORTED AMOUNT	ESTIMATED FAIR VALUE
Assets:		
Cash	$ 427,017	$ 427,017
Investments	375,039,116	438,125,687
Grant/contributions receivable	2,245,288	2,245,288
Liabilities:		
Long-term debt	48,633,307	53,467,224
Note payable	921,457	921,457

The fair value of investments is based on fair market prices. The fair market valuation of grant/contributions receivable was estimated based on past cash collection experience. For long-term debt, the fair values are estimated using the interest rates currently offered for debt with similar terms and remaining maturities. The estimated fair value of mortgages for faculty and staff is based upon similar terms at which similar institutions would provide as part of an overall compensation package to such individuals. The estimated fair value of the note payable is based on the discounted value of the future cash flows expected to be received from the note.

The fair value estimates presented are based on information available to the Institute as of June 30, 2003, and have not been revalued since that date. While the Institute is not aware of any significant factors that would affect the estimates since that date, current estimates of fair value could differ significantly from the amounts disclosed.

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